Late Bronze Age scale armour in the Near East : an experimental investigation of materials, construction, and effectiveness, with a consideration of socio-economic implications

Hulit, Thomas David

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An Experimental Investigation of Materials,
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Thomas David Hulit
The Graduate Society

Volume 1 of 1

Ph.D. Thesis
2002
Department of Archaeology
University of Durham

Abstract for Thomas D. Hulit
Ph.D. thesis
Department of Archaeology
University of Durham

The body armour used in the Late Bronze Age Near East took the form of multiple, evenly formed small pieces of bronze or organic material laced together in rows and affixed to a linen or leather backing. The research in this thesis has examined the existing literature concerning this form of armour and the materials, possible forms of manufacture and construction, the effectiveness, and the socio-economic factors governing its use. A catalogue was compiled and analysed to better understand the range of sizes and shapes of armour scales and the spatial distribution. A contextual analysis was also conducted to this end which also and examination of the artefacts found in association with the armour scales.

Some aspects, but few specific points, of the use of scale body armour can be seen in the ancient depictions and texts. The armour was primarily the province of the wealthy elite, particularly the highly skilled chariot warriors who used a tripartite system of composite bows, chariots, and body armour. To better understand the effectiveness of the armour a series of experiments were conducted in which sections of replica scale armour were manufactured and tested against replica New Kingdom Egyptian archery tackle. Replica sections of armour made from bronze, rawhide and a combination of both bronze and rawhide were tested and proven to be quite effective, showing that scale body armour was an effective item of military equipment. However, the relative rarity of armour scales in the archaeological record suggests that it was still an item partly associated with conspicuous consumption on behalf of the elite.

This thesis is dedicated to my parents,

Ronald and Mary Hulit

Without whose support and encouragement
this thesis could not have been undertaken.

Acknowledgements

First, and foremost, amongst all those whom I must thank are my parents, Ronald and Mary Hulit, and it is to them that this thesis is dedicated. Without their continual support and unfailing encouragement, this work could not have been undertaken. Again, thank you very much.

My thanks also must go to Lena, Nicholas, and John Schmitt, all of whom were also very supportive of both my masters and doctoral theses.

My thanks must also go out to my supervisors, Dr. Graham Philip and Professor Anthony Harding, both of whom aided me in the structure and organization of the thesis and have provided numerous valuable critiques and suggestions. My thanks also to Joan Digney, who conducted a thorough proof-reading in quite a short amount of time.

I must thank Dr. Mohamed Saleh, Dr. Mohamed el-Shimy (both former directors of *The Egyptian Museum*, Cairo) and Dr. Gabala (Director in charge of *The Egyptian Antiquities Department*) who made it possible for me to study the coat of armour from the tomb of TutʿAnkhamūn. Without their permission to study this coat of armour much of the structure of Late Bronze Age scale body armour would have remained unknown. My thanks also to Omamia el-Said, Miss Sohir el-Sawi, Mokhtar Abdo, and Mohamed Mahran (all of *The Egyptian Museum*) for the practical aid and assistance they provided in the analysis of TutʿAnkhamūn's armour.

My thanks also must go to Mr. J. Randall and Mr. Martin Vindy of *E.I.P. Metals Ltd.*, (Birmingham) who graciously provided the bronze which was used in the experimental work conducted for this thesis. Without their aid, much of the experimental work could not have been undertaken. I must also thank John Waller, Andrew Bodley, and all of the staff of *H.M. Royal Armouries Museum* (Leeds) for providing the technical direction, the film footage, the replica composite bow, and the physical space for the experiments. My thanks also to Stuart Davis and Martin Hughes, both of Brighton, who cast the rough blanks for many of the arrowheads used in the experimental work. I must also thank master bowyer Ted McEwen for making the replica composite bow, and both he and his wife Sheila for their hospitality when I visited them in London to discuss Egyptian archery and composite bows. My thanks also to Jim Hodgson and Neil Holmes (University of Durham Chemistry Department Workshops) for manufacturing the dies and jigs which allowed me to shape the armour scales and for permitting me to use the workshops to manufacture both the replica sections of armour and the replica arrows. I must also mention, and thank, *The Copper Development Association*, (U.K.), *The British Non-Ferrous Metals Association, The British Leather Commission* and *Joseph Clayton & Sons, Ltd.* (Chesterfield) respectively for their aid in determining the appropriate modern bronze alloys, and in locating and sourcing the rawhide and alum-tawed leather. My thanks also to *The Timber Research and Development Association* (U.K.) for helping me determine a suitable material for the arrow shafts. Again, without the expertise and aid of all of these people, much of the experimental work could not have been done.

I must also particularly thank many of the members of the Society for Creative Anachronism. It is thanks to the support of these wonderful and creative people that my enthusiasm for studying the use and manufacture of body armour has been maintained over the last few years. My thanks especially to Blake Rink for all the practical information on the construction, fit, and effectiveness of many types of body armour in many historical periods. Without his instruction as to how body armour must fit the wearer, this thesis would have contained many mistakes. My thanks to: Blake Rink and Carol Holm, Sean Goodman, House Blackwood, Aithne Baker and Vicki Smatla, The Barony of Montengarde (Calgary) and the Barony of Bronzehelm (Billings).

There are many others whom I must also thank for their encouragement and help (in many ways) over the duration of my studies: Dr. Jonathan Crowther, Caroline Banks and family, Edward Maher, Chris Huff and Judith Walton, Christopher Constable, Florence Drew, Charlotte Whiting, Matthias Hoffmann, the University of Durham Archery Club, Dr. Toby Wilkinson, Dr. Penny Wilson, Dr. John Ruffle, Dr. John Curtis, Dr. Jenny Jones, Zissis Parras and Aida Costa, Tom Brophy and Tony Hands (*Charles Eagles & Sons, Ltd.*, Durham), Harvey Watts, Tim Baker, Warren Order, Dr. Jaromir Malek and the staff of *The Griffith Institute* (Oxford), Wendy Hodkinson (*The Simon Archery Foundation*, Manchester University Müseum), Grania Lyster and the staff of *The Wallace Collection* (London), Prof. Anson Rainey and Dr. Zipora Cochavi-Rainey, Roy and Helen Simpson (*Eagle Classic Archery*, Nottinghamshire), and Dennis and Jude Hooey (*Archery Unlimited*, Lethbridge).

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Declaration of Original Research

This thesis is the original work of Thomas David Hulit and has been submitted as required for the degree of Doctor of Philosophy in Archaeology at the University of Durham, England, on 11/03/2002. Appendix 1 is based upon the thesis written by the present author as partial qualification for the degree of Master of Arts in Eastern Mediterranean Archaeology at Katholieke Universiteit Leuven, Belgium in 1995/1996.

Declaration of Copyright

Chapter One

Principles of the Use of Armour and the Current Hypotheses on the Origins of Scale Armour and the Materials and Construction thereof.

Introduction

Over the previous 110 years, Late Bronze Age Near Eastern scale body armour has not often been the subject of intensive research. Within archaeological sources scale armour is first noted in some detail in the works of Rawlinson (1881) and Wilkinson (1890), and many of the basic principles which they set forth have been held without challenge up to the present day. Their works were certainly not exhaustive, and they did not have the benefit of studying the collections of armour which have been excavated since their time. Few others presented material on body armour until Yigael Yadin published his work in 1963, and amongst those who have touched upon scale armour and military production in the years since Yadin's text, none have examined scale armour on a wider pan-Near Eastern scale.

The foremost factors which must be determined when studying a style of armour is whether or not it is effective and whether or not it is suited to particular uses. Ineffective armour is a hindrance to the user, and due to its cost, is therefore unlikely to have been issued. Basic principles such as the fit of the armour and the weight are considerations which must be taken into account when establishing the two aforementioned factors. Much of the work that has been presented in the past on armour has not adequately examined these principles, and many untested assumptions have been made as to the effectiveness of armour. Most of the work of the scholars presented below has taken for granted that scale body armour was always made of bronze and was always used by charioteers. Little of the last 100 years of research on Late Bronze Age Near Eastern armour has changed what is known, but only promoted the same ideas, with one author more-or-less following their predecessors. There is little mention of the use of organic elements, primarily leather or other hide products, in their texts, and there has not been a critical assessment of the actual *use* of the armour that did exist.

Many scholars (see Littauer and Crouwel 1996, 1985, Schulman 1995, 1979, Moorey 1986, Hoffmeier 1976, Yadin 1963, and others) have agreed that the advent of scale armour was a response to the introduction of the composite bow and the chariot. There has been a considerable amount of work done, primarily by the scholars noted above, on the use of chariots in the Late Bronze Age and the associated use of archery. Most of the scholars agree that chariots were used as a mobile firing platform, and this thesis does not challenge that point. There is, however, also a very strong possibility that chariots were used in more ways than just this one. The hypothesis is put forth in this chapter, and further discussed in Chapter 5, is that some of the chariotry units were formed of highly trained elite "commando" troops which were trained in all the methods of warfare and equipped with a wide range of weaponry and armour. It is suggested here that it was these troops which made use of scale armour rather than the standard chariot archers, as the "commandos" may have been required to move swiftly into position with the chariots, then dismount and fight on foot. The weight and construction of the armour were important factors for these soldiers, as it must, by design, have been suitable for a variety of tasks. As such, the use of organic and composite organic/metallic armour would have been an option, and it is certain that this form of armour existed, as shall be discussed here and in subsequent chapters of this thesis.

1.1) The Basic Principles of the Use of Armour

The principles of warfare are succinctly summed up by Yigael Yadin (1963: 3) as follows:

> "...in the final analysis the art of warfare is to seek to achieve supremacy over the enemy in three fields: Mobility, Firepower, Security. To put it another way, it is the ability to move troops to engage and injure the enemy without serious injury to oneself."

It is the aim of this thesis to examine the defensive or "security" aspect of the above statement, especially that of the individual soldier in the Late Bronze Age Middle East. The thesis will also examine what effects the use of body armour had on the social and economic organization of society, and the socio-economic factors which governed the use of body armour.

One myth that must be dispelled is that armour will make a soldier invincible. The protection that armour offers will possibly save the soldier's life, but he can still be greatly injured while wearing it, and more to the point, he can be gravely wounded right through the armour, not just in the uncovered, weak points. Essentially, it depends on the form of the armour and the materials from which it is made. An "arms race", a concept broadly discussed by Yadin (1963), not only concerns the offensive weaponry, but also the defensive. Armour of one form or another will also provide protection against minor injuries which might turn septic and thus threaten the life of the soldier out of proportion to the initial severity of the wound. For each new type of armour and the benefits it provides, new weapons will be devised by the opposition in response, a principle which holds true for any period of history. The same is also true in reverse, for each new and more effective weapon or weapons system, better defensive measures, such as improved armour, will be developed.

For armour to be truly useful, it must offer a balance between protection and mobility. This balance generally translates into "more armour = more protection = less mobility", and "less armour = less protection = more mobility. It is necessary to mention that mobility functions in the protection that armour affords in two ways: 1) it allows the wearer to dodge or move out of the way of the attacker's incoming weapon, or raise his shield to stop or deflect that blow, and 2) in the case of retreat, the retreating person must be able to do so quickly. This is part of the "security" aspect mentioned by Yadin (1963: 3), but armour becomes pointless, no matter how well it protects, if the wearer is unable to move. As Glock (1968: 157) states "The thinking behind the armour of the soldier appears to be motivated by desire for mobility".

The two main principles behind the development and use of armour is that it will serve as a substitute for a shield, allowing the soldier to use both hands for the task which he is about (Glock 1968: 186; Yadin 1963: 15), and provide some protection for the wearer against attacks which he is unable to avoid. The drawbacks to armour include the added weight (and therefore decreased mobility) and the time and expense of manufacture (Yadin 1963: 15). Each type of armour will have particular drawbacks, for instance, a coat of bronze scale armour may afford a great deal of protection, but is both relatively heavy (thereby reducing mobility somewhat) and is very costly to produce. Leather armour, on the other hand, would provide somewhat less protection, but would be lighter and cheaper. Many factors governed the use of armour, including the social status of the soldiers in receipt of such armour (see Chapter 5). However, the most important factor governing its use was whether or not armour was suited to the tasks a soldier was to perform.

1.1.1) Armour Fit

It must always be kept in mind whilst studying armour that it is critical that the armour properly fits the individual who will wear it. This is true for almost every type of armour, in most any age, that one might choose to consider. In general terms, the more complex armour becomes, the greater the need for that armour to fit properly.

The style of a given suit of armour will govern how precisely it must fit its owner. Scale armour, generally flexible throughout its construction, will be a more forgiving style so far as fit is concerned. The most important points in fitting this type of armour are overall length, and circumference around the shoulders, chest, hips, and lower hem of the armour. The length must be suited to the task which the soldier will perform but not be so long that it would impede his movements. Proper fit in the shoulders, chest, and hips would allow the soldier to wield a weapon and move his body as he does so. Proper fit around the lower hem of the armour, depending on its length, would allow the soldier to walk or run unhindered.

One of the problems with scale armour is that the majority of the weight of the armour hangs from the shoulders, which may tire the soldier prematurely. One method of alleviating this problem is to belt the armour at the waist, allowing some of the weight to be transferred to the hips, an approach which would also keep the armour from moving too freely and thus interfering with a soldier's movements. Furthermore, the lower half of the armour, a skirt or kilt of varying length (perhaps the "accessory" skirt or *dutiwa* that is mentioned in the Nuzi texts [see Kendall 1974], see Chapter 2.2.1.1, 2.2.1.6), was separate from the upper half of the armour and belted around the waist to more evenly distribute the weight.

The scales in a coat of scale armour are all laced together to form what may be loosely termed a "fabric". As this scale "fabric" can stretch and contract upon itself slightly it would have been a suitable material to construct armour from when outfitting hundreds, or possibly thousands, of soldiers. It may have been possible, with this "fabric", to mass produce armour in several more-or-less standard sizes over the range that would have been needed to equip men of the different sizes which one would expect to encounter in a large group of people. A tunic of cloth may be tailor-made to fit a soldier, then armoured with mass produced bronze or leather scales, resulting in a properly fitted coat of armour with a reduction in both the overall cost and in the amount of time needed for manufacture.

1.2) The Origins of Scale Armour and the Current Hypotheses - Literature Review

The origins of scale armour are somewhat obscure. Kendall (1974: 193) notes that the Ḫurrian word for an armour scale is "*kurșimtu*", "*kurzimtu*", "*gurzimtu*", or "*gurzimedu*" a word which is derived from the older Akkadian word of the same form meaning "snake" or "scales of the snake" (Kendall 1974: 266). The primary meanings suggested in the *Chicago Assyrian Dictionary* (Oppenheim, Reiner, and Biggs 1971: 567-568) for the word *kurşindu* has three meanings: 1) a snake, 2) plate(s) (of armour), and 3) a hatchet. They further suggest that, as the word *quliptu* translates as the scales of fish and some types of snakes, the word *kurşindu* likely means the scales of a snake, which also lends itself to the translation that it means the metal covering on a coat of armour or a door, both of which could be covered with small pieces of metal. It is possible that various scaled creatures may have prompted experimentation at some point in time in an attempt to create a form of flexible defence that a human might wear. It is impossible however to establish when this may have occurred. Gonen (1975: 79) has noted that:

> "Scale armour is a rather sophisticated solution, and we may assume that it was preceded by various lengthy stages of development, nothing of which remains. The earliest coats of mail known to us are already well developed."

One of the earliest accounts of scale body armour in the archaeological literature is that of Sir J. Gardiner Wilkinson (1890, vol. 1) in which he compiled a considerable amount of reasonably accurate information on the military and its equipment without the aid of the information from the archaeological excavations of the subsequent century. Wilkinson (1890: vol.1, 344-345) notes that an Egyptian soldier's defensive equipment basically consisted of a metal helmet or quilted head-piece, a shield, and a coat of armour made from metal plates, but no vambraces or greaves for the protection of the arms or lower legs. Wilkinson derives most of his information on the construction of the coats of scale armour from depictions of them, primarily the coats depicted in the tomb of Ramses III in the Valley of the Kings, Thebes. He described the body of the armour as being constructed of 11 rows of metal plates secured with bronze pins, with a further three rows of smaller plates at the throat. Sleeves were constructed such that they extended no further than the elbow, and the total length of the armour being (usually) sufficient to cover the thighs almost to the knee (Wilkinson 1890: 366).

At the time when Wilkinson was writing there was a section of a corslet in the collection of one Dr. Abbott (presumably an acquaintance of Wilkinson's). It consisted of a series of overlapping scales stitched to a leather doublet. The depiction of the scales that accompany this description are of a later lamellar type pattern, more of which will be discussed below [Fig. 1]. Two of the scales in the corslet have the name of the pharaoh Shishak (Shoshenq) [c. 945-924 BC] inscribed on them (Wilkinson 1890: 368), which would date this armour to the tenth century BC, and therefore somewhat out of the range of this study. Petrie (1917: 38) also makes brief reference to this armour. The method of manufacture used in this section of armour differs considerably from the methods used in the Late Bronze Age, and as such it is not examined here.

Wilkinson (1890: vol. 1, 367-368) suggests that many of both the light and heavy infantry wore a vest of quilted material in the same form as the armour which it was a substitute for, and that some forms would only cover from the breast to the waist, being held up by straps over the shoulders. He does not however state from where this information comes, but presumably it is again from an examination of the depictions of soldiers on the Egyptian temple and tomb reliefs. Depicted with the weaponry in Ramses II's tomb is a garment, which from Wilkinson's (1890: 368) description, was made of some form of textile. He describes it as being "made of rich stuff" with a neat border, a fringed lower hem, and decorated with lions and other animals [Fig. 2]. The same type of corslet was sent by Amasis as a gift to Minerva in Lindus (Wilkinson 1890: 368). This garment may be a form of armour as it is depicted along with other military items, but there is no definitive proof for this. There are depictions of soldiers on Ramses III's temple at Medinet Habu who wear what appear to be textile garments which cover only to the breast [Fig. 3], but the depictions are different enough that no direct comparisons may be made.

Walther Wolf (1926: 92, 96) and Hans Bonnet (1926: 210) make amongst the first statements that it was primarily the charioteers who wore armour, specifically an armoured corslet and a leather helmet, beginning in the 18th Dynasty. Wolf (1926: 96-97) uses only the single example of the coat of scale armour depicted in the Theban tomb of Kenamun (Chief Steward to Amenhotep II [c. 1453-1419 BC]) to examine the structure of armour in New Kingdom Egypt (see Chapter 2.1.2). He suggested that the armour corslets were fashioned from leather shirts to which bronze scales were affixed (Wolf 1926: 98). At this point in the literature there was not yet a detailed discussion on the existence of coats of leather scale armour.

Published in the same year as Wolf's text, Hans Bonnet (1926) discussed Egyptian New Kingdom armour in somewhat greater detail. Bonnet noted (1926: 210) that in the Egyptian Old and Middle Kingdoms no armour was worn, and the upper body remained uncovered, with depictions of armour being uncommon before the 19th Dynasty. Armour was depicted in the 18th Dynasty amongst the tribute brought to Egypt by the Syrians, and Bonnet (1926: 210) suggested that this foreign innovation began to be adopted by the Egyptians at this time. Two basic types of armour were identified: 1) a textile garment covering the torso from the waist to the sternum, held up by straps over the shoulders and as it was always depicted as white, therefore made from strong, padded linen [and decorated with rows of dots or wavy lines to indicate stitching], and 2) a corslet of metal, leather, or wood plates or scales which hung almost to the feet, and which had either short sleeves or none at all (Bonnet 1926: 210-212). Bonnet (1926: 212-214) made comparisons between the constructions of the textile armour and the armour of the Sea Peoples as it appears on the reliefs at Medinet Habu in the time of Ramses III and also compared the scale armour to that used by the Assyrians after the 10th century BC. Bonnet (1926: 214) noted that the depiction of the armoured Syrian charioteer(s) on the chariot body of Thutmosis IV is the earliest depiction of scale body armour, and that it is one of the only Egyptian depictions of an armoured individual of non-Egyptian origin until the numerous depictions of armoured Assyrians appeared four centuries later. Again, there was only brief mention of the use of leather armour in that the leather-workers of New Kingdom Egypt may have recognized the idea of strengthening a garment with leather (Bonnet 1926: 216), but no hypothesis beyond this was put forth.

The primary evidence for leather scale armour comes from the tomb of TutʿAnkhamūn wherein a complete leather corslet (or cuirass) was discovered by Howard Carter in his clearance of the tomb. Packed within an undecorated wooden box was a corslet fashioned from rawhide (untanned leather) scales laced together into rows, each of which was then stitched to the linen backing. Carter (1933: 143) notes:

> "Another form of defensive armour was a crumpled-up leather cuirass that had been thrown into a box. This was made up of scales of thick tinted leather worked onto a linen basis, or lining, in the form of a close-fitting bodice without sleeves. It was unfortunately too far decayed for preservation."

Aside from this note by Carter, TutʿAnkhamūn's cuirass remained unexamined until research for this thesis began in 1997. Reeves (1990: 176) and Schaeffer (1951: 12) both note the existence of the corslet, but neither present any further research concerning it. The method of construction of TutʿAnkhamūn's corslet is clear despite its present poor condition, and an analysis in Chapter 2 provides considerable evidence for the general construction of scale armour throughout the Late Bronze Age Middle East.

R.F.S. Starr (1939: 475-480) contributes the first detailed descriptions of what is one of the most important collections of scale armour from the Middle East. A variety of copper alloy (or bronze) armour scales (and numerous fragments) of different form and sizes were found in the suburban elite houses at the site of Nuzi in Iraq (Starr 1939) and date to c.1475-1450 BC. Within the same general contexts as the armour scales were found a large number of cuneiform clay tablets which document the inventory of the palace armoury and list the soldiers to whom a wide variety of military equipment was issued. A detailed examination of these tablets was conducted by Timothy Kendall (1974, 1981), and a reinterpretation of them appears below in Chapter 2. There were two main types of armour scales found at Nuzi: 1) roughly rectangular scales wherein one end is squared and the other rounded, perforated with a number of small holes, and with a medial strengthening ridge pressed into the scale from back to front, and 2) unperforated rectangular scales with a medial strengthening ridge that is cast into the scale and a single rounded protrusion on one corner (Starr 1939: 476). The perforated armour scales are quite similar to those found throughout the Eastern Mediterranean, whereas the rectangular unperforated scales are unique to Nuzi.

Starr (1939: 478) suggested that the perforated scales found at Nuzi, each slightly curved in the long axis, were laced together side by side into rows which were then fastened to an undergarment such that the long axis of the scales were perpendicular to the length of the body of the wearer and as such be better moulded to the contours of the body. This hypothesis was obviously made without an examination of the depictions from New Kingdom Egypt (e.g. the corslets depicted in the Theban tombs of Kenamun and Ramses III) wherein the scales obviously run lengthwise with the body of the wearer. The second, unperforated type of plates were thought to have been fastened to a heavy undergarment by passing a cord across the scale, into the undergarment and out again, around the protrusion, and then across to the next scale (Starr 1939: 476). Kendall (1974: 269) notes that this hypothetical reconstruction would not adequately fix the scales to the undergarment and strenuous movement would cause them to fall off. Starr (1939: 479-480) suggests that the armour had the appearance of the lamellar Assyrian armour of the 9th and later centuries BC:

> "The large number of plates listed for a single suit is proof of the completeness with which the body was protected, though little more can be said of the general appearance of the completely assembled suit. It seems probable that it had much the same form as the Assyrian armour: a jacket covering the torso and upper arms, extending as a skirt well down toward the knees." (Starr 1939: 479-480).

Lorimer (1950: 197) makes the connection between the armour scales published by Starr (1939) and the suits of armour depicted in New Kingdom Egypt. Lorimer (1950: 197) again cites the corslets depicted in the tomb of Ramses III (also very briefly mentioned by Petrie 1917: 38) recounting almost exactly what Bonnet (1926) had said, adding that the alternating colours of the rows of scales may represent different materials, the yellow being gold, the red being bronze, and the blue bands a lapis-coloured faience (*cyanus*). Faience and gold would probably not be a suitable materials for armour scales as they are too brittle and too soft respectively, and both too heavy, although as Lorimer (1950: 198) notes, they might be suitable for parade armour. There are no Middle Eastern Late Bronze Age archaeological or textual examples to suggest any scale armour was made from gold or faience, but Catling (1970: 448) notes the impressive "corslet" of feather-scales from the tomb of TutʿAnkhamūn which is made entirely of precious metals and lapis lazuli and has the form (more-or-less) of the linen armours which Lorimer (1950: 198; see Bonnet 1926: 211, and above) notes were worn in New Kingdom Egypt.

Yigael Yadin (1963) was the first to hypothesize on the use of armour and examine in depth the effects of the different materials and styles that may have been used in their construction in antiquity. As with the aforementioned scholars, Yadin (1963: 15) noted that the primary advantage of armour was that it left the hands free while still providing protection for the body. The disadvantages he noted was that it was expensive to manufacture, was heavy, and impeded movement. Yadin (1963: 15) mentioned that the least expensive, and lightest, armour would have been made from leather or tough fibre, however the latter was later, and very briefly, discounted by Yeivin (1967: 42-43) as being too thin to protect against any attack. However, Yadin did not follow through with further research into the idea of organic armour and instead focussed on metal-scaled armour which he noted required a high level of technical skill and was costly to manufacture. Furthermore, he noted that the wearer was vulnerable at the joints of the sleeves and between the individual scales. Continuing to expound the virtues of metal scales, Yadin (1963: 15) made the following statement:

> "The big advance toward perfection came with the coat of mail.... Whereas armour made of plates of metal was excessively heavy to wear and interfered with movement, the coat of mail was relatively light and afforded easier movement. It was certainly the best protective device conceived at the time."

The lacing pattern for armour scales that Yadin (1963: 14) illustrates (Fig. 4) is taken from the construction of lamellar armour from the Cypriot Iron Age period, in the style of the armour scales from Nimrud (see also Curtis 1979). This is markedly different to the lacing pattern used for scales in the Late Bronze Age (see i.e. Chapter 2.3.3.6). Much of what Yadin wrote about body armour and warfare in the ancient Near East was based on his interpretations of the ancient texts and the depictions on the ancient monuments. He also made specific note that although some organic remains of military items have been found, little information concerning their use can be made without the use of the depictions and descriptions (Yadin 1963: 25-27).

The find of a single metal armour scale at Mycenae in 1968 prompted Catling (1970) to examine the information again. Catling (1970: 441, 444) notes that scale armour had been unknown in the Mycenaean world until that discovery and suggests that the scale had possibly come from a coat of armour that originated in the Near East, and had been brought to Mycenae by one who had travelled or even fought in the Near East. In his paper Catling draws information from both Mycenaean era depictions of soldiers as well as from Egyptian and Cypriot sources. In specific he notes the armour depicted in the Theban tombs of Kenamun and Ramses III (Catling 1970: 446-447), the draughts-box from Enkomi (Catling 1970: 448), a pair of pictorial kraters from the Enkomi Swedish Tomb 3 (Catling 1970: 448; see also Sjöqvist 1940: fig. 20, 3), and the Warrior Vase from Mycenae (Catling 1970: 442; see also Marinatos and Hirmer 1960: pl. 233).

Catling (1970: 448) notes that the depictions of "soldiers" either driving chariots or walking in procession generally feature them wearing long, usually sleeveless, robes covered with rows (or a random pattern) of dots. He does not however state that these depictions definitely portray scale armour, citing the "...entirely unreliable nature of Mycenaean drawing conventions". Catling continues in suggesting that these dots, which appear also on the sides of chariots, may represent texture just as readily as they might represent armour. Crouwel (1999: 456-457, 461) suggests only that these soldiers wear a short fringed tunic or corslet, but makes no definite statement that these depictions represent armour.

Catling makes no certain claim that scale armour was an innovation adopted by the Mycenaeans, but suggests that there was a shift from the style of armour represented by the heavy plate armour found at Dendra in 1961 in a 15th century BC context (see Verdelis 1977) to a lighter protection such as depicted on the ceramics mentioned above (Catling 1970: 442), but no mention is made as to what form this later armour took. Catling does mention that some similarities do exist between the armour of the two regions, particularly the similar gorgets depicted on the armour from Dendra and the armour depicted in the tomb of Kenamun, a tall tubular collar of bronze (in the case of the Dendra armour) and similar, perhaps of leather, for the armour depicted in Kenamun's tomb (see Yadin 1963: 197). These two approaches to constructing suits of armour are broadly contemporary, both being dated to the late 15th century BC (Catling 1970: 442, 446).

The most important information concerning armour in the Late Bronze Age Eastern Mediterranean are the texts and armour scales found at the site of Nuzi by R.F.S. Starr (see Starr

1937, 1939). The most comprehensive examination of the texts has been conducted by Timothy Kendall in his Ph.D. dissertation at Brandeis University (Massachusetts) in 1974. Kendall (1974: 263) suggests that scale armour was a Hurrian innovation of the 16th century BC and that it was developed as a response to the introduction of the composite bow and the chariot, again citing, as do many scholars, Yadin (1963) [See discussion of this below].

As mentioned above, the texts are a list of equipment provided to, and returned by, soldiers of the city of Arrapḫa (Yorgan Tepe) in the early to mid 15th century BC. These texts provide clues to the general forms of armour found in the Near East at this time, including in some instances specific mention of the numbers of armour scales used to construct a variety of individual coats of armour (Kendall 1974: 270-278). In total, there are 15 different types of armour mentioned in the texts (Kendall 1981: 201), including numerous accounts of composite armour fashioned of both bronze and leather (Kendall 1981: 203; 1974: 191, 213, 314). Throughout Kendall's thesis there is also mention of armour for horses. Within the texts it is often noted that horse armour is issued to soldiers at the same time as they receive their own (human) armour, and the terms used to describe the two types of armour are often synonymous. The descriptions of the armour in the Nuzi texts often present as many questions as they answer as they often describe armour in what seems to be the least detail possible. For example, two texts note a "...corslet of leather for the body" (Kendall 1974: 265, Nuzi texts HSS XV 3: 33; 7: 6) which certainly states that leather armour (presumably without bronze fittings or scales) existed, but provide no clues as to the methods of construction, use, or the tasks to which it was suited.

Two distinct major types of armour are mentioned in the Nuzi texts: the *tarkumazi* and the *sariam*. The *sariam* is the scale armour that is encountered throughout the Near East in the Late Bronze Age. The *tarkumazi* is something different, perhaps a uniform of the palace staff, as it is often mentioned as a separate type of armour being issued along with the *sariam* (see Kendall 1974, 1981). The recipients of the *tarkumazi* armour are the *Tarkumazu* (the "*tarkumazi*-men") who were members of the palace staff regardless of their profession (Kendall 1974: 316). It is possible that these individuals are akin to the conscripted palace guards mentioned by Heltzer (1982: 107) in his translations of the Ugaritic texts [see Chapter 5.1.1].

Very little can be determined from the brief descriptions of this armour, although it is probable that it was made of leather and, as shall be discussed in Chapter 5, that it was perhaps either not particularly useful or was poorly designed, as it was often "cast off" during battle.

Kendall (1974: 280) also notes that there are two distinct types of *sariam*: the "armour of the land of Ḫanigalbat", probably the armour of the charioteers of Ḫanigalbat who were the most elite troops stationed at Arrapḫa, and the "armour of the land of Arrapḫa" variants of which are likely what some of the Arrapḫian charioteers were issued. Several texts describe the numbers of "large copper scales" and "small copper scales" used to construct the coats of armour. Kendall (1974: 276-278) compares the weights of actual scales found at Nuzi (averaging 12 grams for the small scales and 33 grams for the large scales) with these numbers, and derives a set of weights for the armour issued to the soldiers of Arrapḫa [a discussion of these weights and their implications is discussed in Chapter 2]. From these weights Kendall (1974: 279) suggests that due to the amount of metal needed and the cost of manufacture, it is probable that only the elite units of soldiers, the officers, and the wealthy were in possession of armour containing, or made entirely of, metal scales.

Following after Kendall (1974), Karageorghis and Masson (1975) published the discovery of three copper-alloy armour scales from Tomb 12 at Gastria-Alaas in Cyprus, which they suggest are from a Near Eastern-style corslet (Karageorghis and Masson 1975: 210), the style of which is often found in areas dominated by the Hurrian/Mitannian empire (1975: 211). Karageorghis and Masson (1975: 220) suggest from their analysis of the armour scale finds up to 1975 that the first armour, chronologically, dates to the 15th century BC with a purely Asiatic origin. As with Lorimer (1950) and Catling (1970), Karageorghis and Masson (1975: 220) derive their idea on the construction of scale armour from Starr's (1939) report on the armour and texts from Nuzi. They suggest that by the 13th and 12th centuries BC scale armour was in widespread use throughout the Eastern Mediterranean (Karageorghis and Masson 1975: 221).

The foremost examination of the methods of constructing a coat of bronze scale armour has been undertaken by Walter Ventzke (1983). During the 1978 excavation campaign at Kāmid el-Lōz in Lebanon, 184 complete armour scales (and 157 fragments) were found. In the examination of these finds Ventzke (1983: 162) identified nine separate types of scales and then proceeded to hypothesize on the methods used in their manufacture (Ventzke 1983: 167-169) and construct a coat of armour (Ventzke 1983: 169-179). Through a series of experiments he determined that the scales were hammered out of sheet metal rather than cast, and that the process was not especially fast given the types of hand tools used in the Late Bronze Age. Ventzke (1983: 169-170) suggests that the backing material, or undergarment, was probably made of sections of leather, rather than a woven fabric, to which the scales were fixed, after which the sections would be fixed together. This method of construction would also allow relatively easy repairs (Ventzke 1983: 170) if the coats of armour were all of a relatively standard size.

An hypothesis concerning the numbers of scales needed to fashion a complete suit was begun by determining an average size for a male of the Late Bronze Age. For this Ventzke (1983: 171) referred to Kunter's (1977) study of the skeletal remains from Kāmid el-Lōz which suggested an average male individual was 1.67m tall and of approximately European size 48 to 50. Ventzke (1983: 176-179) conducted an in-depth examination into the function of each of the scale types and suggested a suitable location for each of them in the construction of the armour, leading finally to an examination of the weights for a variety of possible finished armours. Through his examination, Ventzke (1983: 181) notes that some 1300 armour scales would be required to construct a single waist-length sleeveless corslet, and upwards of 3300 to construct a long coat of armour such as depicted in the tombs of Kenamun and Ramses III. Table 1 presents the weights of the coats of scale armour and the numbers of scales used therein for both the Kendall's (1974) and Ventzke's (1986) hypotheses. Finally Ventzke (1983: 179) notes that there is no comparable archaeological evidence with which to compare the Kāmid el-Lōz finds, although he makes no mention of the leather corslet from the tomb of TutʿAnkhamūn. A more detailed discussion of Ventzke's (1983) examination of the Kāmid el-Lōz armour and the information from the TutʿAnkhamūn corslet appear in Chapter 2.

The most recent discussion of scale body armour has been put forth by Drews (1993). Drews' hypotheses on the use of armour in the Late Bronze Age are based heavily on the Nuzi armour as presented by Kendall (1974). Drews (1993: 110) notes via Yadin (1963: 84) that body armour was derived from the use of chariots in battle, and that the armour was intended primarily as a defence against enemy missiles (Drews 1993: 124). Furthermore, and without supporting evidence, Drews (1993: 124) claims that coats of scale armour would have been ineffective against attacks with spears and thrusting swords, and that the armour would have been cumbersome, restricting an individual's speed and mobility. Again, it appears as though he assumes that all of the charioteers were making use of metallic scale armour. Some discussion is presented on the change in styles of armour at the end of the Late Bronze Age and the development of the "infantryman's corslet" (Drews 1993: 174-180). Drews' (1993: Chapter 10 [104-134]) hypothesises that the Late Bronze Age polities made almost exclusive use of chariotry, with infantry serving only as runners and supply personnel for the charioteers (pg. 119), despite the fact that large numbers of infantry are known to have existed. His hypotheses on the change in armour are based on the premise that the end of the Bronze Age began when the "barbarians" realized that they, as infantry, could succeed against chariotry when armed with javelins, long thrust-and-slash swords, and "... a few pieces of defensive armour" (Drews 1993: 104). Due to the nature of Drews' (1993) hypotheses on the nature of Late Bronze Age warfare, and the sometimes rather odd ideas he presents, a critical analysis of his hypotheses on armour is not discussed here. The deconstruction of Drews' (1993) hypotheses would require far more space than can be afforded here, and his ideas have already been thoroughly challenged by Dickinson (1999) and Littauer and Crouwel (1996).

Drews' (1993) text suggests that the scale armour corslets were primarily intended for chariot crews is plausible, but he makes no mention of the possibility of leather or composite leather/bronze scale armour (see below and Chapters 2, 3, and 5). The hypotheses on the development of leather infantry armour (Drews 1993: 174-180) primarily concern the use of leather instead of bronze. Drews (1993: 175) correctly states that there is no pictorial evidence for infantry soldiers armed in the long-sleeved and long-skirted Late Bronze Age-style scale armour. He hypothesises that the infantry armour consisted primarily of heavy kilts and waist-length corslets, both probably of leather, greaves, and helmets. The majority of the evidence he cites for this is based on Mycenaean and later Greek examples, including the Warrior Vase and Warrior Stele (pg. 176), and various Homeric references. Littauer and Crouwel (1996: 297-305) and Dickinson (1999: 21-29) both challenge Drews (1993) on many aspects of his hypotheses, particularly those concerning the use of chariotry and infantry, but no comment is made by them concerning the use and development of body armour. Many of Drews' hypotheses on the development of infantry armour are plausible, but as they are heavily based on the Mycenaean and later Greek examples, they are not discussed here. The vast majority of the armour discussed in the present thesis originates in the Late Bronze Age Middle East, with only a few armour scales coming from Cyprus, and a single example from Mycenae, all of which are dealt with in Chapters 2 and 4.

1.3) Chariot Warfare, Composite Bows, and Body Armour: The Tripartite Association.

Body armour in the Late Bronze Age Middle East is most often associated with chariots and composite bows. This tripartite association formed the core equipment of the chariot forces of this period, and an understanding of the manner in which they are linked is important to establish the use of body armour. As shall be discussed in Chapter 5, these three items were primarily used by the wealthy (and highly trained) elite soldiers who belonged to polities in which a palace-based workshop environment existed. The restricted use of this military equipment was primarily due to the high cost of manufacture. A brief introduction will be given in the present chapter on the origins of these technologies, as it is believed that they were all adopted into general use at approximately the same point in time.

1.3.1) Chariot warfare

Although the best representations of armour in use come from the various depictions in New Kingdom Egypt, the chariot and its associated equipment (body armour and composite bows) were not an Egyptian innovation, but were rather the result of a long process of development in Western Asia (see Moorey 1986). Moorey (1986: 198) notes that there is sound documentary evidence for grooms, trainers, and harnessed teams of horses in 18th century BC Syria from Chagar Bazar (Moorey 1986: 198, Gadd 1940: nos. 929, 938, 946, 968, 979) and evidence that horses were prized possessions in Mari in the Middle Bronze Age (Moorey 1986: 198, Dalley 1984: 160). The light horse-drawn chariot initially appears in the Near East, including Egypt, in the 16th century BC after having been established in a more rudimentary form in North Syria and Anatolia in the 17th century BC (Littauer and Crouwel 1985: 96, Hoffmeier 1976: 43, see also Littauer and Crouwel 1996: 298) In the next hundred years or so it became known throughout Asia Minor (Moorey 1986: 196). Littauer and Crouwel (1979: 68) argue that the chariot was a local Near Eastern innovation rather than an intrusive idea introduced by Indo-European speaking peoples (as proposed by most scholars, see Drews 1993, Piggot 1983, 1978, 1979, and Yadin 1963), and that it was a series of local developments and improvements that resulted in chariots being used in battle (Moorey 1986: 200; Littauer and Crouwel 1979: 70).

By the beginning of the Late Bronze Age in the Middle East, the chariot was a well established item, and it is most prominently depicted in its military role. Most scholars agree that the chariot in the Late Bronze Age Middle East was used primarily as a mobile firing platform for archers (see Crouwel 1999, Littauer and Crouwel 1996, Drews 1993, Schulman 1995, Moorey 1986, Gonen 1975, Yadin 1963, etc.). The principle behind the *maryannu* (elite "young heros") chariot warriors was to begin the battle with a rush towards the opposing enemy ranks, strafing them with arrows, and making a hasty retreat at which point the infantry would advance, either to continue the attack begun by the chariotry, or to help save them if their attack failed (Schulman 1995: 295; Earle 1990: 57; Faulkner 1953: 43). It is possible, as Watkins (1989: 31) suggests, that as the chariotry was the most valuable, expensive, and prestigious unit within the military body, it was reserved for use only in critical moments. During the battle, the charioteers may have stood down (Schulman 1995: 294), waiting for the hand-to-hand combat of the infantry troops to subside, at which point they would then (depending which side they were on) turn the victory into a rout by pursuing the retreating/fleeing enemy soldiers (Schulman 1979: 130). It is also likely that, if possible, the long-range missile troops (chariot-based and ground-based archers) would provide assistance by loosing arrows into the enemy ranks as and when they were able (in an endeavour, of course, to avoid hitting their comrades).

The chariot has often been likened to a modern tank in its application in warfare in the Late Bronze Age, an idea which has been attributed to Hitti (1957: 146-147). The concept of the chariot as a "tank" likely found its origins in 5th century Greece (see Xenophon *Cyropaedia* VI.1.30 [Moorey 1986: 203] and *Cyropaedia* VI.1.28 and VI.4.18 [Anderson 1975: 177]), however this idea has been thoroughly, and correctly, dismissed by Moorey (1986: 203), Schulman (1979: 114), and Littauer and Crouwel (1979: 33). The chariot is not built sturdily enough to withstand the shock of impact into a crowd of armed men (unlike a heavily armoured tank), and the horses could not be protected well enough to prevent them from being harmed. Should one, or both, of the horses in a chariot pair be injured, it would render the chariot inoperable at which point it would no longer be of use in battle (Littauer and Crouwel 1996: 298). In addition, the chariot would then be there for the victor to retrieve as war booty, constituting a considerable financial loss to the losing side. The great value that is placed on the horses and chariot is evident in the efforts to armour the horses, chariot body, driver and chariot warrior. The armour all contributed to the effort to ensure that the chariot, horses, and crew all returned from the battle. It should be noted here, however, that Hitti (1957: 146-147) did suggest that an advancing line of chariots would have the *psychological* impact that tanks did in early 20th century AD warfare, but he did not suggest that they were *used* in the same manner.

The most detailed depictions of chariotry come from New Kingdom Egypt, where the chariot was, as is believed by many scholars, introduced by the Hyksos at some point in the Second Intermediate Period (Schulman 1995: 291, 1979: 105; Littauer and Crouwel 1985: 96; Faulkner 1953: 43). It is not, however, possible to establish a precise date for the introduction of this "new" military technology. The use of chariots in an organized fashion requires a formal military establishment which is not considered to have arisen in Egypt until the very end of the 17th or the beginning of the 18th Dynasty (Schulman 1979: 111-113; Hoffmeier 1976: 44). The effective use of the chariot in a coordinated, disciplined fashion required a controlling military body, an institution which was likely to have been initially formed under pharaoh Kamose [1573-1570 BC] prior to the Hyksos being driven from Lower Egypt (see Hoffmeier 1976: 44). At some point during the Hyksos period in Egypt [beginning c. mid to late 18th century BC] (Yalichev 1997: 35, Murnane 1983: 352-353, Winlock 1947: 151) the Egyptians, then with their only the secure base centred around Thebes, began to adopt these innovations. Eventually, Kamose, the last pharaoh of the XVIIth dynasty, succeeded in driving the Hyksos out of Egypt using the newly adopted military equipment (Yalichev 1997: 35, Littauer and Crouwel 1985: 96, Yadin 1963: 75, Winlock 1947: 153, 158).

The chariotry introduced in the Hyksos period was essentially the same as that used in Syria (Schulman 1979: 118), and this is the form in which it was introduced to Egypt: a light two-man chariot (Schulman 1979: 117; and Yadin 1963). The first Egyptian scenes of the chariot being used in a military effort are from the reign of Tut'Ankhamūn [1334-1325 BC] (Davies 1963: pl. 8, see also Hoffmeier 1976: 44). It is also during his reign that the first scenes appear where a second individual is seen riding in the chariot. Before this time, scenes including chariots only depicted hunting, processions, and domestic scenes (Hoffmeier 1976: 44). As for the historical military texts, (see Hoffmeier 1976: 44, 45) the term *kṯn* is the Egyptian term for "charioteer" and *snny* translates as "chariot warrior". The role of the *kṯn* was to drive the chariot while the *snny* was the warrior and is depicted either using a shield to protect the driver, or loosing arrows at the enemy. One of the earliest examples of the term *snny* is in a text from the tomb of Menkheperrasonb (tomb #112 in the Theban Necropolis) and reads *it f snny nḥm f* - "His father was a chariot warrior". As Menkheperrasonb served Thutmosis III [1504-1450 BC], his father would have been a chariot warrior either early in Thutmosis III's reign or before it (Hoffmeier 1976: 44).

The New Kingdom Egyptian chariots have a very wide wheel track to provide stability when quick turns are necessary at high speed and have a bodywork that is approximately the height of the occupant's hip. The rear of the chariot is generally open to permit quick access to the vehicle, and is wide enough to permit two people to stand abreast (Littauer and Crouwel 1985: 98-99). Of the six chariots from the tomb of Tut'Ankhamūn, two chariots (termed by Littauer and Crouwel [1985] as *A1* and *A2*) were considered by Howard Carter (Carter 1927: 54-63) to be "state chariots" which Littauer and Crouwel (1985: 99) suggest were suitable only for parade and ceremonial use due to being almost entirely decorated with gold inlay and birch-bark. Chariot *A3* was decorated only on the wheel naves, rear floor bar, axle tree, pole, frame supports and the frames for the sides, and is considerably more likely to have been for active use, although again due to the decoration, mostly for parades. Furthermore, the sides were made of leather instead of wood, which would give the chariot less weight and more resilience, thereby making it a more serviceable vehicle (Littauer and Crouwel 1985: 99).

Chariot *A4* (as termed by Littauer and Crouwel 1985) is a much more robust vehicle than the first three, and is undecorated. This would have been a functional vehicle, and Littauer and Crouwel suggest that it might have been used for tasks such as travelling while on campaign. There is evidence that this chariot has had one of the four wooden sections of one of the tyres replaced at some point in its active service (Littauer and Crouwel 1985: 100) which suggests that it may actually have been used for its intended purpose. Chariot *A5* is a lightly decorated chariot with leather sides and rawhide tyres over the wooden wheel rim. More lightly built than Chariot *A4*, Littauer and Crouwel (1985: 100) note that Carter (1933: 34, 95) suggested that this chariot, and the more elaborately gilded Chariot *A6*, may have been hunting chariots, and the metal loops fastened to the sides of Chariot *A6* may have been for attaching the wooden bow-case which was found in the tomb.

The depictions of chariots in the rest of the Near East (eg. as depicted on an ivory plaque from Megiddo) suggest that the sides of the chariots were solid, rather than fenestrated or open, and that the body of the chariot may have been longer to possibly accommodate a third crew member (Littauer and Crouwel 1985: 101). The descriptions of TutʿAnkhamūn's chariots above and Near Eastern (non-Egyptian) depictions suggests that at any one given point in time chariots of different designs and levels of decoration were built for different purposes. Chariots underwent changes through time to make them more efficient and suitable for the tasks they were to be used for. Thutmosis III undertook at least 17 military campaigns into Syria-Palestine during his reign, and even during this time, the chariot must have undergone changes to achieve maximum performance (Hoffmeier 1976: 44).

1.3.2) Composite Bows

It was not an arduous task to combine archery and the use of chariotry in a military situation. The bow was an established weapon of war, and its adoption into use with chariotry was easy where the terrain was suitable (Moorey 1986: 208). Composite bows were already in use by foot soldiers in the Akkadian period (Moorey 1986: 209), and it would not be difficult for an archer to take advantage of the increased potential in using a chariot as a mobile firing platform to increase his effectiveness in battle (Littauer and Crouwel 1996: 298, 301; Moorey 1986: 209-210), and as the combination of archery and chariotry required no new technology, it is easy to see how it eventually became "universally adopted" (Schulman 1976: 128). The combined use of archery and chariotry for warfare may have risen from their combined use in hunting (Drews 1993: 106, see also Hoffmeier 1979/1980: 197-198), which is a common later scene in many tomb and temple reliefs in ancient Egypt. The use of composite bows and chariotry by the elite for hunting, perhaps before the beginnings of chariot warfare, further strengthen the association of the tripartite system of composite bows, body armour, and chariotry with the elite military classes (see Chapter 5).

Composite bows and chariots are mentioned together in the Mari Texts dating to the 18th century BC in which both composite and self bows are issued to soldiers along with a chariot while a text describing a chariot includes the mention of a leather quiver (Durand 1983: no. 295, p. 333, Moorey 1986). From the Alalakh Level VII archive comes a list of archers, two of which are noted as possessing chariots, while another text notes a charioteer who is issued a bow (Wiseman 1953: Nos. 205-206, Moorey 1986: 210). This provides fairly solid evidence of the association of chariots and composite bows as early as the later Middle Bronze Age. The issue of these items to soldiers establishes that they were in use in military scenarios at this time, leaving only the innovation of body armour to complete the tripartite association discussed above.

The introduction of the common usage of composite bows to Egypt may also date to within the Hyksos reign, as described above (Moorey 1986: 208; Winlock 1947: 158). The earliest example found is that from the early 16th century tomb of the warrior Ahmose Penhat, the "Attendant and Fanbearer" to Thutmosis I [c. 1524-1518 BC] from grave-pit 1013 in the Sankhkare Cemetery, Thebes and is now in the collection of the Metropolitan Museum of Art, New York (McLeod 1962: 16; see also: Porter and Moss 1927/1951). Yadin (1963: 63) suggests that the composite bow was adopted into common use as a response to the increasing use of body armour despite the increased cost of manufacture, and that one reason for Egypt having adopted the bow later in the Late Bronze Age than the rest of the Near East was that their prime enemies to the south (especially Nubia) did not make use of body armour.

Yadin (1963: 7-8) states that the composite bow could have an effective range of approximately 300 to 400 yards with a maximum potential of sending an arrow 600 to 800 yards. While Yadin's statement above grossly exaggerates the distances possible from the Egyptian composite bows, he is correct that the improvements in archery did have an effect in the development of defensive measure of that time and period. In testing a replica Egyptian angular composite bow (of the same type as that which Yadin is discussing) with a draw-weight of 28.8 kg [63.4 lb.] Bergman, McEwen, and Miller (1988: 663, 667) were able to cast a light-weight 25 gram "flight" arrow (constructed strictly for the purpose of achieving the greatest distance) at an initial velocity of 52 metres per second achieving a total distance of 221 metres [242 yards]. With a heavy, bronze pointed "war arrow" (a replica of an Egyptian bronze-pointed arrow) weighing 90 grams, an initial velocity of 32 metres per second was achieved with a total distance of 109 metres [119 yards]. Although the heavier arrow travelled a considerably shorter distance, it would have greater transference of energy upon impact, and thus do a greater amount of damage to the target.

Although the composite bow was a much more costly item to produce than the self-bows favoured in Egypt before the arrival of the Hyksos, its greater effective power would certainly promote its acceptance into general military usage. A smaller bow possessed of equal or greater power than the older self-bows or simple stave bows, would be useful in more situations, and this would likely result in archery becoming more widely used. As an example, a shorter bow would be much easier to use within the confines of a moving chariot, as the shorter limbs of the bow, especially the lower limb, would be less likely to hit the other occupant of the chariot or the chariot body itself when an arrow was shot. Composite bows can also be left strung for extended periods without taking a set (losing strength in the limbs due to acquiring a permanent bend), thus allowing archers to prepare in advance for combat situations.

1.3.3) Body Armour

The increasing use of chariots and the development of the composite bow both served to prompt better defensive measures. To combat the power of the composite bow, as archers using this type of bow were able to send arrows considerably further and with greater force on impact than before, body armour began to see increased use (Yadin 1963: 8, 84).

Most authors who have touched upon the development of armour in the ancient Middle East generally attribute it to two factors; the rise of chariotry, and the development of the composite bow. (Drews 1993, Moorey 1986, Schulman 1976, Littauer 1972, Yadin 1963, etc.). Chariot warriors, especially with two-man crews (the Ḫurrian and Egyptian chariot crews, for instance), were in need of some protection, as the driver could not effectively manipulate a shield and the reins at the same time, nor could the archer make simultaneous use of a bow and a shield. The charioteers could be protected by a third crewman, carrying a shield, but this third man would put considerable strain on a fairly light vehicle, and was a later innovation (Moorey 1986: 210). As scale armour was an expensive item to produce (Moorey 1986: 212), not every soldier was equipped with it, and therefore in most cases only the chariot crews received it (Yadin 1963:84), and perhaps was restricted to those charioteers of the highest social order or those who were most highly trained (see Chapter 5).

The most obvious reason for granting the chariot crew armour was a desire for them to survive the battle, but the underlying reason may have been more of an economic reasoning (see Chapter 5) than purely altruistic. As the chariot crews were usually highly trained elite units who used very expensive equipment (the chariot, the horses, the armour, and the composite bow) (Schulman 1995: 296), it would be in the best interest of the army to prevent the chariot units falling into enemy hands as war booty. The best way to do this was to ensure, as far as possible, that the crews survived the battle.

Chariot crews could not take a fortified area such as a town, nor could they take and hold an open area. The crew would need to dismount from the chariot and fight on foot (Schulman 1979: 129), which would have been a difficult task if they made use of the very heavy types of armour mentioned in the Nuzi texts. Since the effective strength of the chariot forces within an army was much smaller than the infantry (Schulman 1979: 129), infantry combat would probably not have been the province of the charioteers. Although the primary use of the charioteers was as mobile archers, they were provided with close-range armament should they have been forced into foot combat. The Egyptian chariots in particular are generally depicted carrying javelins or spears, and occasionally swords, as well as the bow case and quiver, whereas the Hittite three-man chariots depicted on the Battle of Kadesh reliefs are shown carrying spears (Beal 1986: 615; Littauer 1972: 148). Similar again are the Ugaritic charioteers who are known to have carried clubs and spears or javelins (Rainey 1965: 22). This suggests that there were weapons available to the charioteers should they find themselves in hand-to-hand combat, and it is possible that this was the case should a chariot have been rendered immobile. It is not known whether the chariot crew were instructed to protect the horses and vehicle in the event that it became immobile, but the provision of close-combat weaponry may suggest that this was the case.

1.3.4) The Use of Chariot Forces - Charioteers as Elite Shock Troops

The tactic of driving a chariot directly into the ranks of the enemy to break their formation is a concept that comes only in the 5th century BC after the chariot had been redesigned and the horses provided with blinkers [as described by Xenophon *Cyropaedia* VI.1.30] (Moorey 1986: 203). Only a highly trained horse can be made to charge into any obstacle against its will (Schulman 1979: 116) hence the use of blinkers to blind the chariot horses in the time of Xenophon. With respect to this, there are no representations in Western Asia and Egypt in the Late Bronze Age to suggest that the light chariot was ever used to charge infantry (Moorey 1986: 203). The chariot was more likely to have been used to transport specific personnel to situations requiring their presence. The numbers of chariotry required to transport large numbers of *regular infantry* to, and about, the battlefield precludes this as a viable option for the use of chariotry. When the number of chariots are mentioned in the Late Bronze Age texts in comparison to the numbers of infantry they usually constitute only a fraction of the manpower of the military, perhaps at a ratio of 1 chariot crew to 500 infantry (Schulman 1979: 129, 133, Drews 1993: 133-134). It is highly unlikely that the chariots were making numerous return trips about the battlefield transporting only one or at most two standard infantry soldiers at a time due to the light construction of the vehicle and the time it would take to transport any effective number of men. Furthermore, there are no contemporary depictions or texts to suggest that this took place.

It is possible, however, that the chariots were used to transport a few select elite soldiers to points where they would be most useful. As described above, for the majority of the battle they would remain mounted on the chariot, travelling about the battlefield delivering a rain of arrows to break up and harass the enemy, but at certain points they may have been used as fast reinforcements or as an "unpredictable" shock force to be used when and where opportunities in the battle arose. With respect to the variety of weaponry that was carried by various chariot ranks as listed above (see Beal 1986: 615, Littauer 1972: 148, Rainey 1965: 22) and the variety of armour described in the Nuzi texts (see Kendall 1974) it is reasonable to assume that the chariot warriors were trained in the use of a variety of weaponry and tactics, and that they were issued with such equipment as would be required for the variety of tasks that they may have been required to perform during the battle (see Schulman 1979: 120). It is very probable that there were a variety of differently equipped chariot crews in any given battle, each held in reserve (Schulman 1995: 294) until the suitable moment.

The above hypothesis would suggest that some of the charioteers wore armour which was suited to the tasks they were to perform. General consensus suggests that the scale armour worn by the charioteers was to protect them mostly against the enemy's return volleys of arrows. This would of course also protect them should their chariot be rendered immobile and foot combat became unavoidable. It is possible that some forms of armour were intended as protection primarily for use while the crew was aboard the chariot, perhaps strictly as mobile archers. The weights calculated by Kendall (1974: 276-278) for the armour mentioned in the Nuzi texts [discussed in detail in Chapter 2] would certainly slow a soldier down if he had to run any great distance, but may have been suitable for a soldier whose specific task it was to fight on foot having been quickly delivered to his appointed place. This may provide one explanation for the different types of armour, and the composite construction employed in some of them, which are also mentioned in the Nuzi texts.

1.4) The Different Basic Types of Body Armour

1.4.1) Bronze scale armour

Pictorial evidence can be found on many of the reliefs of New Kingdom Egypt. The depiction of corslets constructed of what are assumed to be bronze scales appears in the relief painting in the Theban tomb of Ramses III [Fig. 6] which shows approximately 137 large scales in the body of the corslet, and 40 distinctly smaller scales in the sleeves and gorget. In the Theban tomb of Kenamun [Fig. 5] the depiction of the corslet shows 195 scales forming the body, and another 15 in each sleeve, with a total of at least 450 scales in all as the number illustrated would have to be doubled (at the minimum) to account for the reverse side of the armour. This number, as Catling (1970: 446) notes, agrees with the information from the Nuzi texts as described in Kendall's 1974 dissertation, particularly with respect to the corslet depicted in Kenamun's tomb.

One of the coats of scale armour shown in Kenamun's tomb also has a gorget (a tall collar to protect the neck and perhaps the lower part of the face). This is very similar to that found on the roughly contemporary Dendra corslet (see Verdelis 1977), although it is possible that the gorget on Kenamun's corslet was made of leather rather than bronze (Catling 1970: 446), which seems likely as there are no instances of such a piece of defensive armour having been found in Egypt. These similarities suggest either a degree of shared military technology, or a coincidental arrival at similar solution to protecting the neck and face. The depiction of the corslets in the tomb of Ramses III show the gorgets to be formed of two rows of small scales. These gorgets are neither as tall as the Dendra gorget nor the depiction from Kenamun's tomb, but would still have provided some protection for the neck. With respect to this, small armour scales from a gorget would most likely be indistinguishable from small scales used to form a pair of sleeves.

1.4.2) Leather scale armour

Evidence to suggest that most suits of armour were not made of bronze is found in an examination of the total amount of bronze that would be needed to manufacture suits for a large number of charioteers. It is suggested that there may have been up to 2500 chariots in the allied army under the Hittite king at the Battle of Kadesh (Yadin 1963: 112,113), and there were likely both three-man and two-man crews as this body of chariotry was composed of the forces of several regions. It is generally accepted that with three-man crews, only the driver and chariot warrior/archer were issued armour leaving the shield-bearer to defend himself and the other two with a shield, while in two-man crews it is thought that both men may have worn some form of armour. This would result in up to 5000 charioteers and drivers wearing armour. If Yadin's (1963) hypothesis on the numbers of charioteers is correct (and it is almost certainly incorrect, see Chapter 5.2 for a discussion on the numbers and costs of armour), the 1000 plus scales per coat of armour as suggested by Ventzke (1983: 181) would suggest a vast quantity of bronze needed for the construction of these coats of armour (see Chapter 2.3.1.5, 2.3.1.6).

The perishable nature of leather suggests that such armour is likely to be under-represented in the archaeological record. However, leather armour corslets appear in the Amarna texts (Text VAT 395 [Vorderasiatische Teil (der Straatlichen Museen, Berlin], an inventory of gifts from Tušuratta, see Moran 1992: 51-61, and Text EA 22, see Cochavi-Rainey 1999: 71) and are noted separately from the leather horse armour. A leather corslet made without scales may also be the *tarkumazi* mentioned in the Nuzi texts, which is distinct from the *sariam* scale armour corslets worn by the charioteers which Kendall (1974: 319) hypothesises might be a form of light leather armour, possibly a palace uniform.

The hypothesis that some, if not the majority, of armour may have been made of leather, is further strengthened by the discovery of the leather scale corslet in the tomb of TutʿAnkhamūn (see Chapter 2.3.3). Although it is not possible to count the number of scales in the corslet due its extremely fragile state, an estimate of some 2,000 + scales seems reasonable due to their very small size. The examination of the armour did not reveal any metal scales or other metallic fittings, which would suggest that in most archaeological contexts a leather corslet, once it had entirely deteriorated, would leave no trace. Leather, as an organic material, is biodegradable, and hence, this may be one of the reasons that leather scales are virtually unknown save those from the leather corslet from TutʿAnkhamūn's tomb which has had the benefit of dry and soil-free preservation.

Further evidence for leather armour is found in the description of the booty taken by the victorious Egyptians after the Battle of Megiddo. The text states that 200 coats of leather scale armour were seized along with two coats of bronze scale armour. The texts specifically note that two coats of metallic armour had belonged to the "...that enemy" and to the Prince of Megiddo, while the 200 coats of leather armour had belonged to "... his wretched army"(Lichtheim 1976: 33-34, see also Chapter 2.2.2.4). This quite clearly establishes that the coats of metallic scale armour were, at least in this case and probably in general, the province of the wealthy.

1.4.3) Composite leather/bronze armour

Composite coats of mail, utilizing both copper and leather scales, are also noted by Kendall (1974: 266-267) (see also Chapter 2.2.1.4). As described above, the composite coats of mail sometimes had either the front or back of bronze, with the remainder in leather. In all, Kendall (1981: 201) suggests that there are 15 distinct types of armour mentioned in the Nuzi texts, several of which are of composite construction. As discussed above, a Late Bronze Age soldier may have been issued with armour to suit his particular task. For instance, an archer may be issued with a corslet but no sleeves or skirt, so that he is able to easily use his bow without being hindered by the sleeves, and able to quickly change position or retreat without becoming entangled in the armoured skirts.

Archaeological evidence from Kāmid el-Lōz suggests that there were also coats in which leather scales and bronze scales were used within the same section of armour. Ventzke (1983) discusses the armour find from the "Treasury" tomb at Kāmid el-Lōz in great detail and hypothesises on how the scales may have been formed into a coat of armour (see Chapter 2.3.1). Within this site there were 184 complete and 157 fragmentary armour scales made of a copper alloy. Comparing these numbers with the total number of armour scales needed to form a coat of armour, which will be discussed in Chapters 2 and 3 (a total of approximately 1500 scales for a short-sleeved waist-length coat), it is clear that there are not enough armour scales present to form an entire coat of armour. This suggests that either many of the original scales are missing from the tomb or that these scales are all that remains at Kāmid el-Lōz of a composite organic/metallic armour.

1.4.4) Plain Leather corslets

A very simple form of body armour would be a thick coat or corslet made out of one or more layers of leather, resembling a thick shirt or tunic. Unfortunately there are no reliable representations of a garment that is undeniably of this construction. The references to leather armour in the Nuzi texts (see Kendall 1974, 1981) and Tutʿankhamūn's leather scale corslet provide undeniable evidence that leather was used to construct armour, however no information has yet come to light to suggest another form of construction.

Many depictions of soldiers, especially those in the reliefs of New Kingdom Egypt, show soldiers wearing what might be interpreted as simple leather armour. The number of these reliefs and the detail within them are most often insufficient to form any hypotheses. The only such depiction of large enough size and detail is the reliefs of the land and naval battles which Ramses III fought in his 8th regnal year [c. 1185 BC] against the Sea Peoples. The most important of the two for this discussion is the one which depicts the naval battle [Fig. 88] (see Breasted 1930: Plates 37 and 39). The four distinct types of armour which appear in this relief, which shall be discussed in Appendix 1, suggest that a hide product, either leather or rawhide, was the material used in the construction of these coats of armour.

1.4.5) Textile armour

Another form of material from which Late Bronze Age armour may have been made are textiles. To date, no homogenous textile armour has been unearthed in excavations, and as a result, few scholars have discussed the possibility of its existence. The armour worn by some of the soldiers in the period of Ramses II [c. 1290-1233 BC] appears to be a short, close-fitting garment which covers the body from the hips to the level of the nipples, and is held up by a pair of broad straps over the shoulders. Generally painted white in the reliefs, this may represent linen armour (Bonnet 1926: 210-211, Lorimer 1950: 198). As an alternative to leather armour, should the textile be thick enough, it might offer sufficient protection. Furthermore, it may have been a better alternative to metal armour in the intense heat of the Eastern Mediterranean (Lorimer 1950: 211 with respect to linen armour in c. 6th century BC Greece). No evidence is presently forthcoming on the structure or use of textile armour in the Late Bronze Age Middle East, and as such, it is not discussed in this thesis.

Conclusion

The basic hypothesis on the equipment and scale armour of the New Kingdom Egyptian soldiers presented by Wilkinson in 1890 has continued to be presented by other authors up to the present day. It must be stated here that this material, although quite basic, is certainly acceptable, although there has been only a slow development of the ideas since. Wilkinson (1890: vol.1, 344-345) was amongst the first to suggest that the Late Bronze Age scale armour was constructed of small metallic plates fixed to a leather backing. He also (Wilkinson 1890: vol. 1, 367-368) suggested that some soldiers may have used some form of organic (quilted) armour. Hans Bonnet (1926: 210-212) noted for the first time the possibility that the scale armour may have been made of leather or other organic materials such as wood, and it is this important point which, although acknowledged, did not receive the necessary study in later texts. Thus, it primarily due to the investigations of both Wilkinson (1890) and Wolf (1926) that the notion of scale armour being generally constructed of bronze scales on a leather backing remained as the primary idea on the construction of Late Bronze Age armour for the next several decades.

Surprisingly, this notion carried forward, although the idea of organic armour, for the most part, did not.

Subsequent scholars seem to have completely missed the most important artefact in their examination of scale armour. The armour found by Carter in Tutʿ Ankhamūn's tomb represents the most complete coat of Late Bronze Age scale armour in existence, and it was entirely forgotten until Schaeffer mentioned it a footnote in his 1951 (pg. 12) text on the excavations at Ugarit. It is not clear why such an important artefact was overlooked, although it may well have been due to the fact that the generally accepted hypotheses on scale armour (metal scales on a leather backing) did not recognize the effectiveness of organic materials. It is even more surprising due to the publicity and popularity of the tomb. The fairly large quantity of bronze scales found at Nuzi in 1930 (see Starr 1937, 1939) provided significant support for hypotheses involving metallic armour, and perhaps provided sufficient material for contemporary scholars to study. The later work on the ancient military put forth by Lorimer (1950) makes reference to the Nuzi armour, and hypothesised that the different colours of scales in the depictions of armour in Ramses III's tomb may have been made of bronze, gold, and even possibly faience. Again, it is noteworthy that Lorimer did not suggest the possibility of organic armour scales.

The foremost discussion of the military in the Late Bronze Age Eastern Mediterranean is Yigael Yadin's 1963 text. Yadin (1963: 15) observed that the materials, construction, and weight would all have affected the use of armour by the military. Yadin, as the retired Chief of Staff of the Israeli Defence Force, took a more pragmatic approach in his discussion of the military equipment, an approach that had not been taken previously. Although Yadin (1963: 15) did note the possibility that the lightest and cheapest armour could have been made from leather or a thick fibre material, further research into this aspect did not occur. Much of what Yadin presents in his work can be traced back to Wolf (1926) and Bonnet (1926), and to Lorimer (1950). As such, the presentation of the basic ideas on the materials and construction of scale armour did not change.

The research presented by Catling (1970), Kendall (1974, 1981), Karageorghis and Masson (1975), and Ventzke (1983) all have drawn upon the material presented by Yadin (1963), further promoting the ideas that scale armour was metallic. Kendall (1973) presented both the exceptionally important Nuzi military texts, which contain numerous references to scale armour, and the armour itself which was found at Nuzi. In so doing, he based many of his hypotheses on its use on Yadin's (1963) work. Although the Nuzi texts state clearly that organic and composite organic/metallic armour existed (see Chapter 2.2.1.4), he did not present a discussion on the manufacture, construction, or effectiveness of these materials. Ventzke (1983) presented a very technical treatise on the armour found at Kāmid el-Lōz, but again made no reference to the possibility of organic scales. It is not clear whether the lack of information on organic elements in scale body armour is the result of active negligence on the part of the scholars, preferring not to open this "Pandora's Box", or if it was due to the long held belief that armour (of all periods) is always made of metal.

The principle *basic* reason for wearing a coat of armour was to protect the wearer from violent attack. This simple fact was then further complicated by the social and economic factors which governed the production of the armour. The more complicated the armour, the greater the cost, and therefore the less likely it was that it would have been regularly issued to soldiers. The highly trained elite charioteers are generally agreed to have made use of scale body armour, but there is the fact that the wealthy elite and nobility also used armour, but it is not entirely clear if the types of armour used by these two groups were significantly different. It is hypothesised in later chapters that the particular materials and construction of the armour were based on particular tasks. Light, leather armour may have been most suited to archers and soldiers not involved in heavy hand-to-hand combat, where heavier metallic or composite coats of scale armour may have been better suited to the elite "commando" soldiers discussed above. There is also the possibility that the metallic coats of armour, which were generally very heavy (see Table 1 and Chapter 2), may have featured in conspicuous consumption and been primarily intended as parade armour or as a form of dress uniform. These factors, and the general effectiveness of different types of materials, will be discussed in the following chapters.

Chapter Two

The Evidence for Armour: Representational Art, Documentary Sources, and the Archaeological Collections

Introduction

The information dealt with in this chapter can be separated into three major sections: 1) the ancient depictions and artwork, 2) the ancient texts, and 3) the artefactual evidence from archaeological excavations. The ancient depictions are primarily from Egyptian tomb paintings, but some also come from temple walls (i.e. Medinet Habu) and artefacts (i.e. Thutmosis IV's chariot body). The most important group of ancient texts which mention armour are the Ḫurrian military texts from Nuzi, although some information also comes from Egyptian sources. The Nuzi texts are basically a form of inventory of the military equipment issued to the Ḫurrian soldiers in the early 15th century BC. Armour is mentioned occasionally in other texts such as the Amarna Dowry lists which give an account of the dowry sent by Tušratta to the Egyptian pharaoh in the early to mid 14th century BC. The archaeological material presented here is not exhaustive, but instead covers the three most important collections of scale armour; those from Kāmid el-Lōz, Nuzi, and the tomb of Tutʿ Ankhamūn. A full digital catalogue of the archaeological examples, including those from the aforementioned sites, is found on the CD enclosed at the back of this thesis.

The following examination has been undertaken to establish the form, the appearance, and the social significance of the armour. The examination of these three sources together will provide a greater overall understanding of the use of scale armour in the Late Bronze Age Near East. As will be shown, the artwork and texts both show that the armour was generally associated with the elite, and the contexts in which the archaeological examples have been found further substantiates this hypothesis.

2.1) The Evidence from the Ancient Depictions

In the following sections the few existing ancient depictions of scale armour will be assessed. They are all stylized to one degree or another, none of them displaying in detail the complex construction of Late Bronze Age scale armour. This simplification is almost certainly an attempt to conserve the time taken by the artists in the Late Bronze Age to carve or paint the relevant scene. The reliefs on the great monuments (e.g. Medinet Habu) were originally painted after having been carved, and it is likely that some of the detail of the armour has vanished with time just as the painted detail of the various styles of clothing have vanished. It must be noted that much of the artwork of ancient Egypt is somewhat stylised, and often does not portray the items or scenes in what people in the modern world would accept as an accurate depiction. The depictions below are analysed within the relative degree of accuracy to which they were drawn, and as such, the information that arises from the analysis will not give an absolutely accurate picture of armour in the ancient world. As Shaw (1996: 241, 247) notes, the artistic conventions governing the depiction of warfare were established possibly as far back as the prodynastic period and were designed to depict the "universal truths". This could have, given the conservatism of dynastic Egyptian artistic convention, prevented armour from being often depicted in use. Pharaoh would be unlikely to be depicted in armour as that would show that he was vulnerable to enemy attack, and this would not hold well with his semi-divinity. Armour does, however, appear more often in other forms of depictions.

2.1.1) The Tomb of Ramses III

Pictorial evidence of body armour can be found on many of the reliefs of New Kingdom Egypt. The depiction of corslets constructed of what are assumed to be bronze scales appear in the relief paintings in the Theban Tomb of Ramses III [c. 1182-1151 BC] [Fig. 6] (Wise 1981: 21; Wolf 1926: 98; Wilkinson 1890: 345; Champollion 1835: pl. 262). There are 13 coats of scale armour arranged in four stacks. The coats of armour flare towards the lower hem, as would be necessary for the wearer to walk or run properly, and have short sleeves and high collars also constructed of scales. The sleeves are shown extended from the body and the scales that they are fashioned from are shown to be perpendicular to the scales that form the body and collar. This depiction is likely a simplified depiction of the actual design as though the armour was held up by a straight rod passed through the sleeves or a display-stand of some form as Davies (1930: 27) suggests for the representations of armour in the tomb of Kenamun (as discussed below). In relation to the width of the sleeves, the length of the coats of armour suggests that they would cover the body to some point between mid-thigh and mid-calf.

The coats of armour have a variable number scales in their construction, with some of them being formed of both large and small scales while others are made of only large scales. In the corslets with both large and small scales, the body of the armour is formed of the larger scales and the sleeves and collars formed of distinctly smaller scales. It has been possible to examine the original artists' rendering of the armour from a reprint of Champollion's (1844) text on the subject (Fig. 6). This depiction has been used instead of a more modern reprint to avoid the possibility of errors due to numerous re-copying over the years. In Figure 6a there are 186 large scales and 49 small scales. This number doubled to account for the dorsal side of the armour makes a total of 372 large scales and 98 small scales for a sum total of 470 scales. In Figure 6b there are 210 large scales which form the entire armour. This figure, doubled to account for both sides of the armour, presents the sum total of 420 scales. There are a total of 155 large scales in Figure 6c which form the entire armour. This figure doubled makes 310 scales. Finally, there are 167 large scales in Figure 6d which, when doubled, makes 334 scales.

In the four coats of armour in this depiction that it is possible to analyse closely, there are, as described above, differing numbers and sizes of scales. These differences may indicate that different types of armour existed within the Egyptian military during the reign of Ramses III, or it may indicate inconsistency on the part of the artist. As has been explained in Chapter One, the smaller the scales in a coat of armour are, the greater the flexibility the garment will have. This may suggest that there were different types of armour for different tasks (such as sappers, archers, or charioteers), or that there were different levels of craftsmanship and speeds of productions within the palace workshops. A second possibility is that the different numbers of scales are related to a non-military use of the armour. The rows of scales shown in the Ramses III corslet depiction are painted red, blue, or yellow (Catling 1970: 447; Lorimer 1950: 198), and Lorimer (1950: 198) suggests that they may represent parade armour. These coats of armour may be parade armours as Lorimer (1950: 198) suggests, or they may indicate composite suits, with each colour representing a different material. The yellow scales may represent gold, the red scale bronze, and the blue scales lapis lazuli or blue glass paste (Lorimer 1950: 198) (see comment in Chapter 1.2).

During field research in Thebes in the February 2000, the author was able to take photographs of some of the reliefs in Ramses III's tomb, one in particular of a selection of the military equipment in the offering chamber in which the armour was depicted. A comparison of this photograph with the depiction of the same scene in Champollion's (1844) text shows that his rendering of the scene was very accurate. Unfortunately, it also shows the great degree of damage and decay that the reliefs have suffered in the past 160 years. When in the tomb, the author was unable to locate the depictions of the coats of scale armour. As they were depicted relatively close to the floor, where the reliefs are now mostly missing, it is thought that they no longer survive. It was not, however, possible to enter the offering chamber as it was blocked off with clear perspex, so it is possible that the reliefs are close to one of the inner corners and out of the line of sight from the doorway. From the accuracy of Champollion's depictions it is assumed that the representations of the armour that he presents are sufficiently accurate for the analysis in the preceding paragraphs to be used without concern.

2.1.2) The Theban Tomb of Kenamun

In the Theban tomb of Kenamun (Theban tomb #93 in the Tombs of the Nobles complex) there is another depiction with scale armour (Healy 1993: 41; Catling 1970: 446; Yadin 1963: 197; Lorimer 1950; Davies 1930: 27; Bonnet 1926: 212-213; Wolf 1926: 97-98). The two coats are depicted slightly differently than the one shown in the reliefs in the tomb of Ramses III, and are shown along with a wide variety of other military equipment. As Kenamun was primarily the Chief Steward to Amunhotep II [c. 1453-1419 BC], after having served his predecessor Thutmosis III, much of the tribute and gifts were routed through his control before being presented to Pharaoh (Davies 1930: 10-11, 25). The military items, and a wide variety of household goods and food, are part of the New Year's gifts presented to Pharaoh, and it is thought that much of the military equipment is destined to outfit Pharaoh's elite guards (Davies 1930: 25). Davies (1930: 27-28) describes the coats of armour as such [see Figs. 7 and 8]:

> "Two shirts of mail, extended on posts with cross trees. The scales are gold or bronze (yellow); the neck is coloured red, and it is curious if this vulnerable point is left comparatively bare or protected. The foundation shows at the edge, where it is adorned with red and blue lines."

The armour is depicted with broad lower hems and broad cuffs on the sleeves as well as fairly broad collars, none of which appear on the armour depicted in the tomb of Ramses III. The collars, sleeve cuffs and hems are all made of textile and appear to represent the undergarment to which the scales are attached. The coats of armour are portrayed side by side upright as though they are displayed on a stand or rack with the sleeves held out perpendicular to the body (Davies 1930: 27). The body of the coats of armour is shown as having parallel sides which would either make the armour to loose at the shoulders, or too constricting on the legs of the wearer unless it was split at the sides which would reduce the level of protection the armour would offer. The sleeves are shown as being formed from scales fastened in line with the scales forming the body of the armour. If the armour was constructed in this manner the scales of the sleeves would bind against one another should the wearer lower his arms.

The depiction of the corslet shows 195 scales forming the body, and another 15 in each sleeve, for a total of 225 scales forming the front of the armour. This figure, doubled to include the dorsal side of the armour, shows that there would be 450 scales in a coat of armour of this style. This number (and the numbers of scales in the armour depicted in the Tomb of Ramses III) agrees with the information from the Nuzi texts as described in Kendall's (1974) dissertation (see also: Catling 1970: 446), but differs considerably with the numbers of scales calculated by Ventzke (1986) in his analysis of the armour finds from Kāmid el-Lōz in Lebanon (discussed below).

Another feature which is different from the armour depicted in Ramses III's tomb is the gorget which is depicted above the scale armour shown on the right [Fig. 8]. This gorget is similar to that found on the roughly contemporary Dendra corslet [Fig. 9], although it is possible that it was made of leather rather than bronze (Catling 1970: 446) which seems likely as there are no instances of such a piece of defensive armour having been found in Egypt, or perhaps if they have been found, they have not been recognized for what they are. The depiction of the corslets in the tomb of Ramses III shows the high collars (instead of gorgets) to be formed of two rows of small scales. These collars appear as though they would fit closely to the neck and are neither as tall as the Dendra gorget nor the gorget in the depiction from Kenamun's tomb. The high collars depicted on the armour from Ramses III's tomb would not provide as much protection for the lower face as a gorget, but would still have provided some protection for the neck. With respect to this, small armour scales from a gorget would most likely be indistinguishable from small scales used to form a pair of sleeves. The depiction of the scale corslet from Kenamun's tomb is painted yellow and is thought by both Yadin (1963: 197) and Lorimer (1950: 197-198) to most likely represent bronze. This, along with the actual bronze scales found in archaeological sites and the textual references to bronze armour (i.e. the Nuzi military texts), definitely establish that bronze scale armour existed.

2.1.3) The Tomb of Paimosi

Depicted in the Tomb of Paimosi, a "sealer of the storehouse of goods and a follower of the king in all foreign lands" (Manniche 1988: 91), are a pair of scale armour coats similar to those depicted in the tombs of Ramses III and Kenamun [Fig. 10]. The tomb is Number 13 in the complex of the Tombs of the Nobles near the village of Sheikh Abd el-Qurna in Thebes (Lepsius 1842-1845: Vol 5; pl. 64), and is tentatively dated to the middle to later part of the XVIIIth dynasty (Manniche 1988: 91). The armour is depicted along with a variety of other goods delivered as offerings for the afterlife. Included in the offerings are a wide range of easily identifiable military items including one self-bow, three scourges, six maces, six axes, six khopesh swords, seven straight daggers or short-swords, seven shields, and ten quivers of four different designs and two different sizes. A variety of other household items such as furniture are shown, all below a series of depictions of a variety of Egyptian deities.

The coats of armour, as with the coat depicted in the Tomb of Paimosi, are slightly stylized and do not accurately reflect the actual construction of the coats of armour. The armour depicted on the left has a total of 296 scales while the armour on the right has a total of 235 scales. When these figures are doubled to reflect the number of scale in the whole coat of armour rather than only on the front, they number 592 scales for the left-hand armour and 470 scales for the right-hand depiction.

The coats of armour are depicted with distinct lower hems, cuffs to the short sleeves, and narrow rounded collars. Depicted above the coat on the right is a gorget similar to that shown above the coat of armour in tomb of Kenamun. The sides of the gorget are curved inwards more steeply than that depicted in the Tomb of Kenamun, but both gorgets have rims on the upper and lower edges as well as a (strengthening?) ridge running the circumference of the gorget at approximately mid-length. By the shape of these gorgets it may be assumed that they are made of bronze. It may be hypothesized that the presence of only one gorget in Tomb 13 in the complex of the Tombs of the Nobles suggests that the armour could be worn with or without a gorget, perhaps depending on individual preference or governed by the task at hand. A third gorget is depicted on the chariot body of Thutmosis IV (described below) being worn by a wounded Semitic charioteer. It also has an upper and lower rim, but lacks a central ridge as depicted on the gorgets discussed above.

The coats of armour depicted in the Tombs of Ramses III and Kenamun show the rows of armour scales in the coats as being painted in a variety of colours. The depictions of armour in Tomb 13 in the Tombs of the Nobles complex are not recorded in such detail however. Lepsius (1842-1845) rendered only a very few colour copies of the depictions in the tombs, and his depictions from Tomb 13 are all simple, although detailed, black and white line drawings. The artwork in Kenamun's tomb is regarded as being exceptionally fine, and was copied numerous times in later generations as can be seen by the copying lines which overlay the original artwork (Davies 1930: 61). It is possible that the similarity of the coats of armour depicted in Paimosi's tomb to those depicted and Kenamun's tomb is a result of this "borrowing" of the artwork. In fact, the weaponry depicted to the right and left of the coats of armour in both Kenamun's tomb and Paimosi's are all but identical, down to the patterns on the quivers depicted to the right of the armour (see Fig. 8).

Davies (1930: 24) states that the variety of weaponry, armour and other goods were New Year's gifts being brought to the palace, and was only passing through the hands of the Steward (Kenamun) before being presented. This could therefore suggest that the coats of armour depicted did not belong to Kenamun, and were possibly destined for Pharaoh's use. Although Kenamun had a wide variety of official titles (Davies 1930: 10; there are some 80 phrases distinguishing Kenamun's role in the Egyptian court), he himself may not have been of a military background, or wealthy enough, to justify the possession of a coat of scale armour.

2.1.4) The Thutmosis IV Chariot Body

The depictions of scale armour in the tombs are somewhat more detailed than other depictions of armour, but offer no indication of the use of the armour. To establish who the recipients of the armour were, and for what purposes it was used, depictions outside of the tombs must be examined. There are coats of scale armour shown being worn by the Asiatic soldiers depicted on the chariot body found within the tomb of Thutmosis IV [c. 1419-1386 BC]. The chariot body is constructed of a wooden frame and panels, the latter of which are covered with canvas to serve as a base for the gesso (gypsum plaster) decoration on which the battle scenes are depicted. The decoration, of which the battle reliefs are a part, are moulded in very low relief in the gesso (Carter and Newberry 1904: 26). Depicted within the reliefs are four Asiatic enemy soldiers who wear coats of scale armour, as well as 45 more Asiatic soldiers who wear a variety of clothing, some of which may be armour [Figs. 11 and 12]. As there is no definite proof that any of the clothing depicted on the chariot actually represents armour, only the most likely will be examined. The coats of scales armour depicted vary from waist-length to hip-length, or perhaps longer.

There are three Asiatic soldiers wearing armour depicted on the outer face of the right-hand (if one was standing in the chariot) side of the chariot body, and a fourth on the outer face of the left-hand panel. The Asiatic soldiers are all depicted in distress or injured regardless of whether or not they wear armour. The coat of armour most prominently displayed on the chariot body is worn by an Asiatic charioteer on the right-hand panel [Fig. 11a] who is being chased by pharaoh, who stands in his chariot along with the god Mentu. The Asiatic soldier looks over his shoulder while holding the reigns of his chariot in both hands while he is fleeing. The soldier has taken one of pharaoh's arrows in his upper body at the point where the sleeve of the armour joins the body of the armour. Yadin suggests that the composite bows in use in Egypt in the New Kingdom were capable of piercing the weaker points of a coat of scale armour (Yadin 1963: 196). This possibility will be examined in Chapter 3 in the section on the effectiveness of replica scale armour against archery tackle.

The armour worn by this individual has short sleeves, a short gorget or collar, perhaps made of leather, and reaches either to the waist or perhaps lower to the hips or mid-calf. The soldier is depicted wearing a belt which may serve to support the weight of the armoured skirts, or perhaps signifies that the armoured skirts were a separate piece of armour as is noted in the Nuzi military texts (discussed below). The full length of the armoured skirts is unknown, as the individual's body is obscured from the thigh downwards by the chariot in which he stands. The gorget is depicted as having an upper and lower rim and some form of decoration represented in the form of three rows of dots. This may represent stitching if the gorget was of leather, or an embossed design if the gorget was made of metal. Approximately 85 scales are shown in the armour on the upper body with approximately another 20 scales shown below the belt.

The other two Asiatic warriors depicted on the right-hand panel of Thutmosis IV's chariot body who wear armour [Figs. 11b and 11c] are shown to wear short-sleeved waist-length coats of armour over a long-sleeved undergarment. The warrior depicted as Figure 11b, shown falling out of the overturned chariot in which he was travelling, has most of his body obscured by the hindquarters of the chariot horses, his quiver, and the body panels of his chariot, thus making a count of the visible scales of little use. It can be noted however, that the sleeves of the armour end in a banded cuff similar to those depicted on the armour from the tombs of Paimosi and Kenamun. The third warrior on the right-hand panel [Fig. 11c] is kneeling and holding a composite bow in his left hand while looking over his shoulder towards Pharaoh. He is missing his right hand in the typical Egyptian representation of a slain enemy soldier (even though he still looks fairly alert). At his collar there is a looped-form necklace similar to that worn by several other soldiers on these panels, and again, a considerable amount of his body is obscured, precluding an accurate scale count.

The fourth figure shown wearing scale armour is on the outer face of the left-hand panel of the chariot body [Fig. 12a]. He is depicted as being run over by pharaoh's chariot and his body is shown bent at an awkward angle. As with only one other soldier depicted on the chariot body, he is facing forwards rather than to the side. The coat of armour he wears is partially obscured by his head, his quiver, and two other Asiatic soldiers. The armour he wears either does not have sleeves, or the sleeves are obscured by his head. He does, however, wear a long-sleeved garment which presumably continues beneath his armour. His skirt, covered with a pattern of closely spaced circles or dots similar to a shirt worn by another soldier on this panel, may represent a different form of armour, but there is nothing to substantiate this hypothesis.

Figures 11 and 12 are taken from Yadin (1963: 192-193) and it is not certain that the copy that he presents is absolutely accurate to Thutmosis IV's chariot body itself, and as such, the numbers of scales and their relative size does not lead to any solid conclusions. With due caution, it may be noted that the depictions of the individual scales in relation to the size of the armour depicted in the tombs of Ramses III, Kenamun, and Paimosi noted above are of similar size with respect to the overall size of the armour. It is obvious from the wounded soldiers that the armour is not impenetrable, however as they are depicted in combat with pharaoh, who as a divine being is more-or-less all powerful, the Asiatic soldiers would be doomed regardless of any defensive measures taken.

What is noticeable in this scene is that both waist-length and longer coats of armour were used at the same time. The Nuzi texts, discussed below, further this fact, describing some 15 different suits of armour that existed within the armouries (Kendall 1981: 201). Kendall (1974: 281, 283) believes that the Asiatic soldiers represented on the chariot body wear armour similar to that described in the Nuzi texts (described below).

2.1.5) The Ramses III Medinet Habu Naval Battle

There are also soldiers depicted wearing armour within the reliefs at Medinet Habu in Thebes. The temple of Medinet Habu has been well recorded by the artists working with Breasted (1930) in recording the remains of the temple reliefs before they were entirely weathered away. On the North face of Ramses III's temple is the relief of the Naval Battle in which pharaoh's naval forces join in battle against the Sea Peoples on their ships in the Nile Delta. There are six Egyptian soldiers depicted who wear what may be interpreted as scale body armour. Five of these soldiers are archers (one with the bow slung around his shoulders) [Figs. 13 and 14] one wields a scourge (a form of a slender mace) and a small shield with a round top [Fig. 15]. The scale armour coats in this relief are depicted quite simply, and it is possible that much of the original detail was originally painted on the reliefs and has been weathered away. The coats of armour are shown as simple waist-length tunics with a series of horizontal lines running across them from either the breast or the collar to the waist. The horizontal lines can be tentatively interpreted as rows of scales on an armoured corslet, the vertical lines which would have delineated the individual scales having originally been applied with paint.

The sleeves generally have a series of vertical lines which, when the arms are depicted as being held out from the body, are perpendicular to the lines on the body. These may be equivalent, although less detailed, representations of the perpendicular (to the body) scales in the sleeves of the corslets depicted in the tomb of Ramses III. The most complete representation of the scale armour on this relief is the single soldier shown in the prow of a ship wielding a scourge and shield [Fig. 15]. The garment worn by this figure has clearly defined lines which may be interpreted as 10 rows of scales in the body, 7 rows of scales in the right sleeve and 6 rows in the left sleeve (the inaccuracy may be accounted for in the modern artist's rendering). The last row or two in the sleeves may be a cuff as seen in the tombs of Kenamun and Paimosi, or may actually be rows of scales. The upper chest area of this armour, that which would cover the area of the collar-bones of the soldiers and the tops of the shoulders is depicted as being empty of lines. There is no other pictorial record of scale armour having this style of construction, and it may indicate that this area was either left unarmoured or that the detail in this area of the armour was painted onto the relief.

2.1.6) Ramses III Equipping his Troops from Medinet Habu

A relief at Medinet Habu which shows Ramses III equipping his troops for the land and sea battles against the Sea Peoples includes what may be interpreted as body armour. Depicted are a number of "corselets", either stacked or hanging, along with helmets and various weapons behind an official scribe who is recording the allocation of equipment [Fig. 16] (see Breasted 1930). There is no fine carved detail remaining on this relief which might indicate that these garments were armour, however it may be possible that this detail, as in the tombs of Paimosi, Kenamun, and Ramses III, was painted onto the relief and has now weathered off. Again, in comparison with the width of the sleeves, these "corslets" appear to be longer than waist-length. As they appear along with helmets and various weaponry, it is not beyond reason to hypothesise that they depict armour. This depiction shows that the allocation of military equipment, as is known from the Nuzi texts, was carefully recorded, each soldier probably receiving only what was needed.

2.1.7) The Sea Peoples' Armour depicted in the Naval Battle relief at Medinet Habu

A very simple form of body armour would be a thick coat or corslet made out of one or more layers of leather, resembling a thick shirt or tunic. Unfortunately there are no reliable representations of a garment that is undeniably of this construction. The references to leather armour in the Nuzi texts (see Kendall 1974, 1981) and TutʿAnkhamūn's leather scale corslet provide undeniable evidence that leather was used to construct armour, however no information has yet come to light to suggest any another form of construction.

Many depictions of soldiers, especially those in the reliefs of New Kingdom Egypt, show soldiers wearing what might be interpreted as simple leather armour. The number of these reliefs and the detail within them are most often insufficient to form any hypotheses. The only such depiction of large enough size and detail is the reliefs of the land and naval battles which Ramses III fought in his 8th regnal year [c. 1174 BC] against the Sea Peoples. The most important of these two reliefs for this discussion are those which depict the naval battle [see Appendix 1 and Fig. 88] (Breasted 1930: Plates 37 and 39).

Four basic types of armour are depicted, with one style in particular being the most common. This type of armour is formed of several overlapping bands, or lames, of leather with a broad band at the lower hem and a breast- and back plate at the top which covers the upper chest and back. In each of the four styles of this armour [see Figs. 90 to 93 and Appendix 1] the components for the front are all attached to each other as are the sections for the back, such that broad gaps would not open during movement. The two halves are then attached to one another, possibly with laces down the sides [for details on construction, see Appendix 1]

Leather armour in the Sea People's style would be much easier to manufacture (see Appendix 1 where the replication of an example of this style of armour is discussed). The leather would have been much cheaper than bronze, and probably took fewer specialized skills to form into useable armour. Sheet-metal armour, due to its inflexible nature, would have to be custom fitted to each soldier, thereby increasing the amount of labour involved in the manufacture. The leather would be much easier to obtain, and much more quickly formed into the required shapes (Hulit 1996: 13).

The fact that no surviving examples of metal armour of this style exist also suggests that an organic material was used. The final point that may suggest that the armour was made of leather is that in the relief of the naval battle, the dead and injured Sea Peoples soldiers which have fallen overboard appear to be floating (there are instances in the Naval Battle relief [Fig. 88] of a Sea Peoples soldier being pulled out of the water). If a soldier was wearing metal armour of 10 kg or more in weight, plus the padding beneath it and other clothing which would soak up water, it is likely that he would sink if he fell into the sea (Hulit 1995: 14). This bit of conjecture is, of course, based on how one interprets the relief, a scene which is all too sparse in detail.

2.2) The Documentary Evidence

2.2.1) The Nuzi Texts

Beginning in 1894, and continuing through the mid 1920's, large numbers of clay tablets bearing cuneiform inscriptions were found at the site of Yorgan Tepe near the modern city of Kirkuk in North Eastern Iraq (Starr 1939: 1-2). Within this group of texts there are over three hundred that concern the military of the Ḫurrian peoples of the Late Bronze Age. The texts are published in two main sets of volumes; *The Publications of the Baghdad School: Joint Expedition with the Iraq Museum at Nuzi* [JEN], and the *Harvard Semitic Series* [HSS] (Kendall 1974: 1-3, 7, 11). Kendall (1974) relies on these translations, as well as providing some of his own, for his analysis of the military issues within them. It must also be noted here that this examination of the Nuzi texts is concerned only with the content of the military texts rather than a linguistic critique, and as such, the translations used, and given, by Kendall will also be used here.

The texts which are examined below are only those which refer specifically to body armour. There are many texts which refer to the *gurpisu,* which Kendall believes is a form of helmet (Kendall 1981, 1974), but these shall be discussed only when they are of specific importance to the use, construction, or maintenance of armour for the body.

2.2.1.1) The different types of armour listed in the texts and their construction

Within the Nuzi military texts there are numerous references to armour, some of which make specific mention of the various separate sections that are combined to form a whole suit. The Ḫurrian word *sariam* translates as "armour" (Kendall 1974: 263), but it is not a term specific to only one style of armour. As will be discussed below, there are suits of armour referred to as "armour of the land of Ḫanigalbat" and "armour of the land of Arrapḫa", as well as the *tarkumazi* and any variety of armour constructed of leather, copper, or a composite of both, in different styles. There is often no mention of the material that the armour is made of, and often there is also no specific mention that the armour is constructed of scales laced together in rows.

Kendall (1974: 263) notes that the armour is:

> "...a type of body armour which was almost entirely of lamellar or cataphratic construction, consisting of a woollen or leather base fabric to which were sewn as many overlapping rows of metal scales as would completely cover the undergarment and provide for its wearer a nearly impenetrable yet flexible metal skin.".

This statement is basically true of all scale armour, however one point which must be corrected is that scale armour is not of lamellar construction. Scale armour is laced such that the rows of scales hang downwards overlapping the row beneath, and any given row of scales is most often not attached to the row beneath. Lamellar armour is laced such that a row of scales overlaps the row above and is connected to it (Robinson 1967: 2). Cataphratic armour scales are held together with wires passing through the holes in the scales (Robinson 1967: 6) in a form not overly dissimilar to the construction of scale armour.

The armour mentioned in the texts from Nuzi is constructed in several pieces: a) the body of the armour, b) the sleeves [*ahi*], c) the armoured skirts [*dutiwa*], d) the helmet [*gurpisu*], and the neckpiece or gorget [*tikku*]. Each of these items is mentioned in the Nuzi texts either as part of a set of armour, or on their own in cases where an individual lost them in battle, or they were in need of repairs.

2.2.1.2) The Armour for the Body and for the Arms

> "[x] hundred and 79 copper scales of the large size for the body, [x] hundred copper scales of the small size for the sleeves, 246 scales of the large size, of leather to Aḫillika are given, and a corslet he shall make." HSS XV: 11 (Kendall 1974: 340; Starr 1939: 541).

> "500 scales for his body, 500 scales for his sleeves, 200 DITTO for his helmet. 1200 scales of copper, Ninkitešup took; 500 DITTO for his body, 500 DITTO for his sleeves, 200 DITTO for his helmet; 1200 DITTO of copper.......took; 560 DITTO for his body, 160 DITTO for his sleeves, [x] hundred and 40 (?) DITTO for his helmet, [x] hundred and 60 DITTO of copper, ...-ia took. [x] hundred and 20 DITTO for his body, [x] hundred and 20 (?) DITTO for his sleeves; 120 (?) DITTO for his helmet, 720 DITTO of copper, Hana'a took; 2 suits of armour of the land of Ḫanigalbat. 2 suits of DITTO of the land of Arrapḫa, of the *emanti* of Kurmišenni." HSS XV: 5 (Kendall 1974: 341-342)

Scale armour for the body is mentioned in numerous texts often with the numbers of scales from which it is made, and is noted in some texts, as above, as being constructed of "large scales of/for the body". With respect to the two texts above, where there is mention of large scales for the body and small scales for the sleeves in some texts and no mention of the locations of large and small scales in other texts, it is taken by Kendall (1974, 1981) that the large scales are for the body and the small scales are for the sleeves.

The numbers of scales in a suit of armour seem to vary considerably as in the texts above. "Bel-aḫi son of Teḫiptilla took a copper corslet for his body (containing) 400 large scales and 280 small scales, and its sleeves and its skirts were of copper." [part of HSS XV: 3 (Kendall 1974: 342-344)]. Three more suits of metal scale armour are mentioned in this text are taken from the palace by other soldiers and contain: a) 598 large scales and 540 small scales, b) 400 large scales and 360 small scales, and c) 435 large scales and 312 small scales. Each of these four suits of armour is specifically noted as having the sleeves and skirts made of copper, and accompanied with metal helmets, three of which are noted as being made of copper scales. One helmet is specifically made of scales of the *kakaniašwa* type which is notable as there is no other mention specific types of scales other than "large" or "small".

Kendall (1974: 277-278) has tabulated the range of numbers of scales that could be present in a suit of armour mentioned in the Nuzi texts. They range from 400 large scales and 279 small scales (total of 679 scales) to 598 large scales and 540 small scales (for a total of 1138 scales). These numbers will be compared later in this chapter with the figures calculated by Ventzke (1986) in his model of the possible reconstructions of the armour used at Kāmid el-Lōz. The numbers here, however, suggest that the suits of armour used at Nuzi were constructed in different styles as is suggested in HSS XV: 5 (Kendall 1974: 341-342) with the phrase: "...2 suits of armour of the land of Ḫanigalbat. 2 suits of DITTO of the land of Arrapḫa, of the *emanti* of Kurmišenni." As Nuzi (in the land of Arrapḫa) was within the jurisdiction of the land of Ḫanigalbat (Mitanni), it certainly possible that different styles of armour were used by different groups.

Mitanni supplied Arrapḫa with an unspecified number of Ḫanigalbatian chariotry to strengthen the forces there who were treated with extreme hospitality (Kendall 1974: 19, 63), and it is very likely that they brought most of their own equipment with them, however repairs and spare equipment could have been made by the armourers at Nuzi. Aside from the mention of these two distinctly different types of armour, the only other indication as to their precise construction is that the Ḫanigalbatian armour may have had long sleeves whereas the Arrapḫian armour had short sleeves (Kendall 1974: 63). As such, the Ḫanigalbatian armour may have been worn by the elite charioteers (the chariot archer) while the Arrapḫian armour was worn by the driver, who may also have served as the shield bearer (Kendall 1974: 280-281). It is possible that the different types of armour were only uniforms or costumes suited to indicate rank, or that they indicated different types of service. It may be that the "armour of the land of Ḫanigalbat" was worn by the elite *maryannu* charioteers and the "armour of the land of Arrapḫa" was worn by the less highly-trained "conscripted" charioteers (Kendall 1981: 210). It must be noted though, that conscripts may not have received training enough to enable them to make proper use of a chariot and its associated equipment.

2.2.1.3) Armour with [x] number of kalkus

The term *kalku* appears in descriptions of coats of armour in the Nuzi texts, and is noted in the Chicago Assyrian Dictionary (Vol. K, pg. 77) as being "...part, attachment, or ornament of a coat of mail or helmet". Some indication of the construction of the body section of the suits of armour may be found in the following text:

> "One suit of leather armour for the body of a man (with) seven *kalkus* about its girth, and its sleeves of copper. One suit of leather armour for the body of a man (with) three *kalkus* about its girth, and its sleeves of copper. One suit of leather armour for the body of a man (with) four *kalkus* and its sleeves of copper weighing one mina and eighty-five shekels. One suit of leather armour for the body of a man, whose sleeves are copper." JEN 527 (Kendall 1974: 344-346, see also CAD Vol. K, pg. 77 similar).

There is also mention of a coat of armour "...with eight *kalkus* around its girth..." in JEN 533 (Kendall 1974: 347). It is possible that the term *kalku* refers to a row of scales in the body of an armoured corslet. This hypothesis was examined by the author using scales replicated for the experimental section of this thesis (see Chapter 3.1 for the manufacture of these scales), which are an adapted replica of some of the scales found at Kāmid el-Lōz (see below) and not dissimilar in size to some of the scales from Nuzi. According to the layering of the scales there should be 16 rows of scales in a waist-length corslet where the rows begin at the collar and extend to the waist. In the girth (the diameter of the torso) of such a coat of armour there would be 10 rows, or *kalkus*, of scales where the uppermost row of the girth is the first row is to extend beneath the arms, the last being at the waist. This suggests that the scales used in the experiment are either shorter than the scales used in the *kalku*-girded armour at Nuzi, or that this is not the method used in their construction.

While Kendall (1974: 269-270) suggests that the scales used in fashioning a *kalku* are the Type 1 scales in his typology (see the section on the Nuzi armour below), in his 1981 paper (Kendall 1981: 202) he recants and suggests that the *kalku* are flaps which hang from the coat of armour to protect the thighs, suggesting that the mention of *kalku*'s hanging from a *gurpisu* helmet may refer to a mantle or gorget-like item rather than to armour for the torso. The *kalku*, as Kendall suggests, may be vertical strips of some material hanging from the belt (Kendall 1981: 209), or they may be an indicator of the length of the armoured skirts, eg. three, four, seven, or eight rows of scales. As there are no recognized examples, either depictions or artefacts, of an item which may be a *kalku*, or part of one, it is not possible to elaborate further.

2.2.1.4) The Leather Armour

Armour for the body constructed entirely of leather is mentioned most often in the following text:

> "...armour for his body of leather...and a helmet....... of copper, one tempered sword...were given to Kirizampula...armour for his body of leather and a helmet of copper, horse armour which is half of leather...and a back pad with a *milu* of leather and a *milu* of copper, a helmet of copper...of bronze, and a tempered sword to the hand of ...were given...armour for his body of leather...horse armour of leather with a *milu* of copper, one bow, one tempered sword...of copper to the hand of Kamiri were given...armour for his body of leather with its back of copper, ...but without horse armour...of leather and half of *taḫabšu* matting, a helmet of copper and a second helmet of DITTO...of copper, one bow whose arms are bronze, and 18 arrows of copper to the hand of Pai were given. As for ...-ipkiapu, armour of leather without a helmet, horse armour, half of *taḫabšu* matting...their helmets...one bow, one tempered sword, to the hand of...were given...armour for his body of copper, a helmet of copper, horse armour, half of *taḫabšu* matting and half of DITTO...of copper, one copper helmet to the hand of Namḫerruta were given, ...armour for his body of copper, a helmet of leather, horse armour half of *taḫabšu* matting...a helmet of copper with...*karinita* of copper...[x] + 4 arrows of copper, 2 bows, to the hand of ...-la were given...armour of copper and a helmet of copper, and half of *taḫabšu* matting... with its back of copper...arrows of copper...one bow...to the hand of ...-e were given...armour of copper and a helmet, horse armour, half of *taḫabšu* matting, a helmet with its back of copper...of copper, arrows of copper, 20 bronze arrows, ...to the hand of Paltea were given...armour for his body of leather and a helmet...there are not, horse helmets of copper...to the hand of Teššuia were given... HSS XV: 4 (Kendall 1974: 348-350).

Along with the text above, texts HSS XV: 3 (Kendall 1974: 342-344), HSS XIV: 236 (Kendall 1974: 333), JEN 533 (Kendall 1974: 347), JEN 527 (Kendall 1974: 344-346) and several others all refer specifically to suits of leather armour being issued to, or requisitioned by, various soldiers but no mention is made of the form that these armours take. They seem to often be issued with a variety of other military equipment including horse armour for the chariot horses. There are also numerous texts in which body armour is mentioned without reference to specifics of its material or construction, so it is possible that these also refer to coats of leather scale armour as the expensive copper or bronze is not specifically mentioned. It may also refer to coats of leather armour constructed in some fashion not requiring scales at all.

Composite armour formed of both bronze and leather is also mentioned in the texts. In text HSS XV: 11 (see above and Starr 1939: 541) there is specific mention of 246 large leather scales being used along with [x] hundred copper scales in the construction of a single coat of armour. This certainly suggests that composite armour existed. Text HSS XIV: 616 (Kendall 1974: 375-376) refers to "... one suit of armour for his body with its skirt and helmet of copper...". This text may suggest that the body and sleeves were not made of copper while the skirt and helmet were, or it may suggest that the skirt in particular was made of copper if, perhaps, they usually were not.

The body and sleeves of some forms of armour were also made of different materials. Leather body armour with copper sleeves is mentioned in HSS XIII: 195 (Kendall 1974: 351) and in JEN 527 (Kendall 1974: 344-346) (see also: Kendall 1974: 265). It is not known why armour of this construction was manufactured as an arrow or severe blow to the body would cause mortal injury far more likely than a similar blow to the arms, and metal armour of the same construction as leather armour would almost certainly provide more protection (see Chapter 3.3 and 3.4). Armour for the body, the back of which is made of copper and the front of leather (HSS XV: 4 [Kendall 1974: 348-350]), is mentioned, and again, it seems as though a blow from hand-to-hand combat would be more likely to strike the front than the back. The obvious use for this type of armour, although it is not mentioned in the Nuzi texts, is that it would be used by a sapper, working at undermining the city walls. This activity could benefit from a lighter front to the armour with a strong back. The composite forms of armour mentioned here may simply be one method used to lessen the weight of the armour.

Using the above, although they are not specifically mentioned, coats of armour with leather sleeves and a metal body may have existed as well as armour in which only the front was metal (Ventzke 1983: 173) to better take the blows in hand-to-hand combat, but whose back was of leather to afford a lighter weight for mobility. A coat of armour of this construction may be mentioned in HSS XIII: 195 (Kendall 1974: 351) where it reads "Three sets of body armour of copper; one set of body armour for the breast (weighing) one mina of copper).

2.2.1.5) Association of armour as "belonging" to the chariot

Many of the Nuzi texts mention chariots, and often with them are listed a range of equipment. In the text below, one of many similar texts, suits of armour are listed as though they are part of a set of chariot equipment (Kendall 1974: 281), and not an item generally issued on its own:

> "...chariots of the hand of...2 suits of armour in each; 5 chariots of hand of Akiptašenni, and in the midst of 3 chariots, one suit of armour; 15 chariots of the hand of Keltešup, and in the midst of 3 chariots, one suit of armour; 12 chariots of the hand of Tarmitilla son of Ḫutia, and in the midst of 4 chariots, one suit of armour; 12 chariots of the hand of Nirḫitilla with 2 suits of armour in each; 36 chariots of the *emanti* of the *ḫurizati*, and in the midst of 3 chariot teams there is one suit of armour each; 5 chariots of the land of Kawinni, and 4 suits of armour in each; 15 chariots of the hand of Akiptašenni, and in the midst of 3 chariots, one suit of armour each; ...chariots of the hand of Turartešup...(left edge)...is written" HSS XV: 82 (Kendall 1974: 331-332).

Text HSS XV: 13 (Kendall 1974: 326-327) is another text similar to the one above which notes those who were in possession of chariots and the numbers of suits of armour with each and lists at the end "A total of 161 chariots of the right (flank) that went." The 161 chariots, their equipment and "owners" are listed as being sent off to serve somewhere, perhaps on campaign or as a garrison reinforcement.

The primary difficulty in issuing a set combination of chariot/armour/weaponry to a pair of individuals is that the armour may not fit the recipients, which is a factor that must have been taken into account. While there is no evidence to support or deny the possibility, it may be hypothesised that the texts which list individuals receiving coats of scale armour are keeping a record of those extra suits of armour issued to soldiers whom the standard issue did not fit.

2.2.1.6) The Tarkumazi Armour

There is also another form of body armour mentioned in the Nuzi texts. This armour is termed the *tarkumazi*, and was likely a form of body armour worn by the palace staff known as the *Tarkumazu* (Kendall 1974: 316). The *tarkumazi*-uniform seems to have consisted of several parts. Text HSS XV 12 (Kendall 1974: 353-355) mentions the armour, sword, helmet, and sleeves "of his *tarkumazi*" which are damaged or lost. As these are all mentioned in a text which is an account of damaged and lost military equipment (including human body armour associated with a chariot), it may be hypothesised that they are part of a set of equipment issued by the palace to the *Tarkumazu.* The *tarkumazi* uniform may also have included a gorget [*tikku*], and possibly an armoured skirt [*dutiwa*] (Kendall 1974: 316-318).

The *dutiwa* is a problematic word within the descriptions of the armour. Kendall suggests in his Ph.D. (1974: 183-187) that the *dutiwa* is an armoured skirt which protects the groin, thighs, and may reach to some point below the knees. In his 1981 text, he recants and suggests that it refers to the crossed straps, or bandoliers, and round pectoral plate that are seen in contemporary Late Bronze Age depictions from other points in the Middle East (Kendall 1981: 202). It is questionable how much added protection the crossed bandoliers and round pectoral plates would have provided, although they are a feature that continues well into the Assyrian period (see Barnnet 1962 for examples of these reliefs featuring Assyrian soldiers). The light weight of a pair of leather straps and a single bronze disc would, perhaps, make them a less likely item to remove if a soldier was fleeing, and it seems that the soldiers often lost their *dutiwa* while in service. A heavy, encumbering skirt of leather or, especially, bronze scales would be a far more likely item to dispose of if a speedy retreat was necessary.

Text HSS XV: 12 (Kendall 1974: 353-355) begins with the line "Tablet of the armour of the men who are dwellers of the palace;...". This text notes a number of individuals who have lost their armour, or pieces of it, or have damaged armour in need of replacement or repair. In text HSS XV: 3 (Kendall 1974: 342-344) Bel-aḫi (a soldier) is noted as taking both a copper corslet for his body made of 400 large scale and 280 small scales which included sleeves and a skirt of copper as well as taking a copper scale helmet (of 190 scales) and a leather corslet of his *tarkumazi.* Both of these texts mention the *tarkumazi* a number of times, but do not detail the construction (Kendall 1974: 316). However, they are always noted as being made of leather, and as such they may be a form of armour which has left no recognizable archaeological traces aside from their mention in the Nuzi texts. The *tarkumazi* is also at times referred to as a specific item and also as a complete uniform (Kendall 1974: 317), which further complicates the identification of its precise form.

The role that the *Tarkumazu* personnel performed is unclear, but there is some suggestion in the texts that they may have been workers in charge of tending the horses (Kendall 1974: 162-163). The question that arises from this is why a groom would need an armoured palace uniform and why should he be supplied with weaponry? Did the *Tarkumazu* serve in battle along with all the other soldiers? The palace personnel, as stated above, are thought to have been the recipients of this type of armour, and it is notable that Bel-aḫi has taken two distinctly different suits of armour. This would suggest that he served both in the standard army, probably as a charioteer, and as a *Tarkumazu* of the palace, assuming that the *tarkumazi* that he took was for his own use (see also the discussion of the *tarkumazi* in Chapter 5.1.1).

There are a number of references in HSS XV: 12 (Kendall 1974: 353-355) and other texts of soldiers whose armour "...is cast off behind them..." (Kendall 1974: 317), and specific problems with the *tarkumazi* seem to have been with the gorgets and the skirts, both of which are mentioned in HSS XV: 12 (Kendall 1974: 353-355) as being cast off. It is possible that the gorget and the skirts were the easiest items to remove to allow greater mobility, and as such were the first, and most common, items to be lost.

It seems far more common for the *tarkumazi* armour to be cast off than the scale armour that was issued to the charioteers. This may indicate different possibilities: First, it may indicate that the armour was not particularly valuable, and it was permissible to leave the armour behind if it hindered a soldier in is tasks or when he was in flight. Second, it may suggest that the *tarkumazi* armour was not particularly effective, and regardless of its value, a soldier would remove the armour to save his life. The value of the armour is probably not insubstantial as its loss was recorded in the palace inventory. It may be that the option of losing the armour was available only to those of higher social status, although there is no textual or archaeological evidence for this (see Chapter 5.3).

2.2.1.7) Inspection lists, sub-standard armour, and repairs

Much like most modern military organizations, it seems that all the soldiers at Nuzi went through periodic inspections. While there are no references as to which individuals conducted the inspections, the records survive (the Nuzi texts as discussed above), and it is in these records that much of the information on the armour is found. The text HSS XV: 12 (Kendall 1974: 353-355) [discussed above] is the "The tablet of the armour of the men who are dwellers of the palace" and it is an account of those whose armour has not been properly maintained. It seems most likely that the soldiers were to go to the armouries and have their armour either repaired or replaced. One line reads "As for Amumitešup, the sleeves of (his) *tarkumazi* he will make anew." which suggests that some of the upkeep was the responsibility of the individual soldiers. Armour was not, however the only item inspected. Text HSS XV: 21 (SMN 2204) (Kendall 1974: 355-357) is a text devoted to the inspection of archery tackle which mentions any amount of archery tackle which was not up to the required standards, and again the soldiers were to see that their equipment was either repaired or replaced.

There are several texts which mention equipment "...that did not go to [a given place]..." presumably due to faults with the equipment. Text HSS XV: 39 (Kendall 1974: 32) lists "58 chariots of the left [wing]" and "36 chariots of the right [wing]" which did not go into service. This shows that there was probably something wrong with at least 94 chariots which required service before battle, which were to be serviced by the armoury or workshops. As shall be discussed in Chapter 5.1.3, the governors (or *bêl dimtu*) of each of the towns and plantations under control of Arrapḫa were responsible for protecting their own territory. As a part of this, each governor was directly responsible for maintaining a garrison and armoury and was able to requisition equipment from the palace (Kendall 1974: 53-54). With the palace supplying all the required equipment, it is certain to have supported a large number of craftsmen and labourers, and with a large army, many must have been employed almost continually in making repairs.

2.2.1.8) Conclusions on the Nuzi Texts

It is a fascinating fact that the majority of the records dealing with armour in the Nuzi archives are concerned primarily with keeping track of those who have either requisitioned or been issued with equipment. The texts which specifically mention the characteristics of the armour suggest that accurate records of the manufacture, in this case the numbers of scales of each suit, were also kept, or perhaps that the quartermaster knew the contents of his armoury particularly well. These texts may also be a record of the value of each coat of armour, especially if *only the numbers of bronze scales were noted by the scribes of the inventory.*

Elite members of society such as Prince Šilwitešup appear to have kept their armour at their own homes (as shall be discussed below), but it is not clear whether or not they owned the armour themselves. As many of the texts note the particular people to whom armour was issued, and one in particular notes a fellow who will repair the sleeves of his armour, it is probable that the upkeep was at least partly the responsibility of the soldier.

Each of the different types of armour mentioned above suggest that different people were issued with armour suited to the tasks that they were to perform. The *Tarkumazu* were issued with their armoured uniform and weaponry while the elite Ḫanigalbatian charioteers and the local Arrapḫian charioteers each had their own equipment provided. This equipment, however, was maintained principally by the state presumably in an effort to maintain a fighting force at the ready. The Nuzi texts show that there was a close association between body armour and the palace or government officials. The use and ownership of armour was rarely, if ever, the prerogative of the individual. This may be a factor of the cost or value of the armour or perhaps a factor of the government attempting to control the use and ownership of military equipment to prevent it from falling into undesirable hands.

2.2.2) The Other Late Bronze Age Texts

2.2.2.1) Introduction

Other documents from the Late Bronze Age Middle East also occasionally contain references to body armour. The most informative are the Nuzi texts, as have been discussed above, but a broader picture is obtained when they are compared to the other available texts. The Old Testament references to armour are generally not overly descriptive, but as they come from several different books of the Bible, they help to broaden the over-all view of armour in the Late Bronze Age. The fact that they are written from a Hebrew perspective introduces a bias which is countered by the Egyptian and Hurrian texts of a broadly similar period. All of the texts show that the armour was the province of high-status individuals, and as such, it appears in texts describing notable events and lists of tribute and booty. In these instances the armour often does not have any particular role in the event other than its presence. Furthermore, the Egyptian texts often read more like accountancy than history, which is perhaps due to the early development of Egyptian accounting systems (Shaw 1996: 248, 251).

It must be recognized that the precise date at which the Old Testament was recorded is debated (see Soggin 1976: 59), but probably well into the first millennium BC. As such, the texts referring to armour are not entirely reliable. Certain aspects of materials and construction may have been mis-translated upon transferring the oral history to written form. Furthermore, each translation into another language may introduce further inconsistencies, such as 17th century AD martial terms being used in the translation of the Latin version into the King James. The Biblical texts are presented here to complement the Late Bronze Age texts and are not intended to provide direct evidence on the materials and construction of armour in this period.

2.2.2.2) The Biblical Texts

It is recognized here that the Old Testament texts are not entirely reliable in an archaeological examination. The stories were most likely written down in the late 7th or early 6th century BC (Soggin 1976: 59), and were still suffering many forms of distortion and alteration as late as the 3rd century BC (Fohrer 1968: 39). The later translation into the King James version, as used here, may also have introduced inaccuracies. The oral tradition which carried many of these stories to later periods have almost certainly introduced later elements into earlier stories (i.e. Goliath's greaves, see below). The Biblical texts are presented here to complete the textual analysis, and are not taken as firm evidence at any point.

The biblical passage which is most descriptive of armour is that which describes the Philistine champion Goliath, just prior to his issuing the challenge to the Israelites:

> "And there went out a champion out of the camp of the Philistines, named Goliath, of Gath, whose height was six cubits and a span. And he had an helmet of brass upon his head, and he was armed with a coat of mail; and the weight of the coat was five thousand shekels of brass. And he had greaves of brass upon his legs, and a target of brass between his shoulders." 1 Samuel 17:4-6

The coat of mail described here would be much like those depicted in the tombs of Kenamun, Paimosi, and Ramses III. There are no other references to greaves in Late Bronze Age Middle Eastern texts, and none have been found in the archaeological record, so this reference to Goliath wearing a pair of them is unique, and possibly anachronistic. However, as he was the champion of the Philistine peoples, he likely would have had the pick of the best arms and armour, and may have chosen greaves to augment his panoply contrary to the standard equipment of the time. The "target of brass between his shoulders" indicates a small, perhaps round, shield slung across his back until needed. The helmet of brass is likely a standard helmet as can be seen in the depictions throughout ancient Egypt, specifically in the tomb reliefs and being worn by the soldiers on the Thutmosis IV chariot body (described above).

Goliath's armour is listed as being made of "5000 shekels of brass". Brass is an intentional alloy of copper and zinc which was not common in the Middle East until later in the Iron Age, and was only introduced to Egypt in approximately 30 BC (Tylecote 1992: 57). There are some artefacts from Palestine and Cyprus which date to between 1800 and 1400 BC which contain up to 3% zinc, however this is almost certainly unintentional (Tylecote 1992: 57). The material used to make armour in the Late Bronze Age was most likely bronze. Plain copper was used in this time period for the manufacture of armour, such as is mentioned in the Nuzi texts, but for forming the complex compound curves of a helmet, a more malleable metal would be more suitable, hence the use of bronze. As it is an alloy that is mentioned in the text above, it is most likely that this reference is to bronze rather than copper or brass.

At 5000 shekels, Goliath would have had a remarkably heavy suit of armour. With one shekel equalling 8.40 grams (as at Nuzi, see Kendall 1981: 211 via Cross 1937: 11), Goliath's coat of armour alone would have weighed exactly 42 kilograms. This weight would not have included his helmet, shield (his "target"), and weaponry, all of which would have added to a greater total. The heaviest coat of scale armour mentioned in the Nuzi texts weighed 25.86 kg (Kendall 1974: 276-278, see also Table 1), while the heaviest armour from Kāmid el-Lōz weighed 26.67 kilograms (Ventzke 1986: 178, see also Table 1). Compared to these two examples, Goliath's armour was almost twice the weight of the heaviest coats for which there is evidence from the other ancient texts and the archaeological record. If Goliath *was* between 9 feet 7 inches (2.91m) and 11 feet 2 inches (3.40m) tall (see Grandet 2000: 494 for weights and measures conversions of the cubit), and granted Goliath's height does account for the Biblical "mythical licence", only then could his armour have weighed over 42 kilograms.

The necessity for the armour to fit the soldier who will wear it may be seen in the following passage:

> "And Saul armed David with his armour, and he put an helmet of brass upon his head; also he armed him with a coat of mail. And David girded his sword upon his armour, and he assayed to go; for he had not proved it. And David said unto Saul, I cannot go with these; for I have not proved them. And David put them off him. And he took his staff in his hand, and chose him five smooth stones out of the brook, and put them in a shepherd's bag which he had, even in a scrip; and his sling was in his hand: and he drew near to the Philistines." 1 Samuel 17:38-40

As Saul arms David with his own armour, one must either assume that Saul and David were of very similar physical build, or that Saul's armour did not fit David. Depending on how one interprets the phrase "...for he had not proved it/them", it may refer to the fact that the armour did not fit and that David believed that he would be hindered by the ill-fitting armour rather than protected. It is possible that he removed the armour, once he had tried it on, and found it did not fit, and decided to rely instead on distance and mobility to protect himself (his use of the sling and stone rather than the sword).

In the two passages describing the "robe of the ē-phŏd", there is specific mention that it should be strongly made.

> "And thou shalt make the robe of the ē-phŏd all of blue. And there shall be an hole in the top of it, in the midst thereof: it shall have a binding of woven work round the hole of it, as it were the hole of an habergeon, that it be not rent." Exodus 28:31-32

> "And he made the robe of the ē-phŏd of woven work, all of blue. And there was an hole in the midst of the robe, as the hole of an habergeon, with a band round about the hole, that it should not rend." Exodus 39:22-23

The habergeon is a form of medieval armour made of textile with metal plates attached to the inside, and is not dissimilar in some ways to the Late Bronze Age coat of scale armour, should one be turned inside-out. In the two passages above, there is specific mention that the collar of the robe of the ē-phŏd should be made like the collar on a coat of armour. The collars (note: *not* the tall cylindrical gorget) depicted on the coats of armour depicted in the tombs of Kenamun and

Paimosi are broad, and in the case of Kenamun's tomb, coloured red and blue. A strong collar would be needed in a coat of metal scale armour so that the seams would not tear by the weight of the armour alone, nor in battle when the garment would see considerable stress. That an item of religious clothing (what is a robe of the ē'phŏd?) is made to such specifications shows that it was well known amongst tailors and armourers which parts of clothing and armour needed to be well-made.

Although the armour did offer considerable protection, it did not make the wearer invincible:

> "And a certain man drew a bow at a venture, and smote the king of Israel between the joints of his armour: wherefore he said unto the driver of his chariot, Turn thine hand and carry me out of the host; for I am wounded. And the battle increased that day: and the king was stayed up in his chariot against the Syrians, and died at even: and the blood ran out of the wound into the midst of the chariot." 1 Kings 22:34-35

The passage above illustrates three particular points. The armour is again in a high status situation, being worn by the Israelite king Ahab. The second point is that the armour is associated with the chariot, an issue which occurs in the Nuzi texts many times. The third point is that the armour did not provide absolute protection. The king was mortally injured by an arrow taken through a gap in the armour. Scale armour does have vulnerable points, especially at the join of the sleeves to the body and at each place between the scales. There are always multiple layers of scales covering the body as the scales overlap (as discussed below), but an arrow striking at an oblique angle to the body and against the pattern in which the scales lay may penetrate beneath the armour (see Chapter 3.3.2).

The socio-economic value of a coat of armour, its association with high status, and possibly its religious significance, is seen in the passages below:

> "And David took the head of the Philistine, and brought it to Jerusalem; but he put his armour in his tent." 1 Samuel 17:54

"And it came to pass on the morrow, when the Philistines came to strip the slain, that they found Saul and his three sons fallen in mount Gilboa. And they cut off his head, and stripped off his armour, and sent into the land of the Philistines round about, to publish it in the house of their idols, and among the people. And they put his armour in the house of Ashtaroth: and they fastened his body to the wall of Beth Shan." 1 Samuel 31:8-10

"And it came to pass on the morrow, when the Philistines came to strip the slain, that they found Saul and his sons fallen in mount Gilboa. And when they had stripped him, they took his head, and his armour, and sent into the land of the Philistines round about, to carry tidings unto their idols, and to the people. And they put his armour in the house of their gods, and fastened his head in the temple of Dagon." 1 Chronicles 10:8-10

"So the king died, and was brought to Samaria; and they buried the king in Samaria. And one washed the chariot in the pool of Samaria; and the dogs licked up his blood; and they washed his armour; according to the word of the Lord which he spake." 1 Kings 22:37-38

Each of the above passages, although the second and third passages above describe the same event, shows the value placed on coats of scale armour. Although there is no mention that the armour was made of metal scales in the passages dealing with Saul and Ahab, or that it was metal armour at all, it is still a high status item associated with the elite, and in this case, the king. David takes Goliath's head to Jerusalem just as the Philistines take Saul's head (after parading it about the country) to Beth Shan, and in both cases the armour was kept, with Saul's armour being placed as an offering in the temple of Ashtaroth (a possible literary parallel with the armour found in temple contexts as noted in Chapter 4.5.2). David could not have worn an armour made for a man so much larger than himself, so it was not for his own use that he kept it. The dedication of Saul's armour in the temple may suggest that it was valuable as it had belonged to the king, although it was probably more symbolically valuable than in "cash" terms.

In the fourth passage, the armour and the chariot are washed in the pool at Samaria, presumably either that they be cleaned before they were entirely ruined, or for a more ritualistic reason. In either event, they were kept, and in this case, according to holy command.

The personal value that was placed upon armour is well illustrated in the passage below:

> "And Hezekiah hearkened unto them, and shewed them all the house of his precious things, the silver, and the gold, and the spices, and the precious ointment, and all the house of his armour, and all that was found in his treasures: there was nothing in his house, nor in all his dominion, that Hezekiah shewed them not." 2 Kings 20:13

The armour is specifically recorded as amongst the greatest treasures in Hezekiah's possession. The statement "...and all the house of his armour..." probably refers to the household armoury, and as such may include without explicit statement all the rest of the weaponry and military equipment Hezekiah may have owned. An archaeological example of a household armoury was found at Nuzi within the house of Prince Šilwitešup (Kendall 1974; Starr 1939) which will be discussed below. Although no precious metals were found within this room, this context did contain a considerable portion of the armour and weaponry found at Nuzi. The value of armour, both symbolic and as a commodity, is seen in the shipment of armour amongst the dowry sent from Tušratta of Mitanni to Pharaoh (probably Amunhotep III as discussed below in Chapter 2.2.2.3 [see also Chapter 5.3]) as documented in the Amarna letters.

A parallel to the value and status associated with armour in contemporary Egypt is illustrated in the following:

> "And all the earth sought to Solomon, to hear his wisdom, which God had put in his heart. And they brought every man his present, vessels of silver, and vessels of gold, and garments, and armour, and spices, horses, and mules, a rate year by year. And Solomon gathered together chariots and horsemen: and he had a thousand and four hundred chariots, and twelve thousand horsemen, whom he bestowed in the cities for chariots, and with the king at Jerusalem." 1 Kings 10:24-25

This passage is very reminiscent of the tribute and gifts sent to pharaoh, and it is notable that armour, a serviceable item, takes such pride of place amongst gold and silver, although one may argue that the other items are also of use. The presence of armour does suggest that it caught the eye or ear of whoever recorded these events. In the tombs of Ramses III, Kenamun, and Paimosi, the armour is depicted as being brought to pharaoh as tribute or as New Year's gifts, and the items depicted are broadly similar to those described above. Valuable gifts often appear in the Egyptian texts and it is not uncommon that they also include various military equipment.

2.2.2.3) The Amarna Dowry Lists

The Amarna tablets first began to be unearthed in 1887 at the site of Amarna on the el-ʿAmārna plain on the east bank of the Nile about 300 km south of Cairo (Cochavi-Rainey 1999: 1; Moran 1992: xiii). Some 350 of the texts are letters and inventories, mostly those received by Egypt, but a few were also written in Egypt to be sent out (Moran 1992: xvi). The majority of the tablets are written in cuneiform text in the Akkadian language(Cochavi-Rainey 1999: 2,4). The texts span a length of time which may be as little as 15 years or as much as 30, depending on how the co-regencies that existed in and around the Amarna period are determined. The texts in the Amarna archive likely begin in about the 30^{th} year of Amunhotep III's reign [c. 1386-1349 BC] and end at about the beginning of Tutʿankhamūn's reign [c. 1334-1325 BC] (Moran 1992: xxxiv).

There are two texts which mention body armour, both of which concern Tušratta of Mitanni. Text EA 22 (from the reign of Amunhotep III and written in a Hurrianized form of Akkadian) is a list of goods sent by Tušratta to Pharaoh as a marriage dowry, and the other (text VAT 422) a letter about marriage and friendship also sent from Tušratta to Pharaoh (probably Akhenaten). Determining the identity of the pharaoh to whom any given text is sent is difficult as the pharaoh is almost never specifically named (Moran 1992: xxxv). It is likely that the pharaoh who was to marry the Mitannian princess was either Amunhotep III [c. 1386-1349 BC] or Amunhotep IV (Akhenaten) [c. 13501334 BC] (Cochavi-Rainey 1999: 2).

The text EA 22 is a long inventory of goods sent by Tušratta to pharaoh as dowry for the one of the Mitannian princesses. A large part of this particular inventory is military equipment including all manner of weapons, chariots and related equipment, and body armour, all of very fine workmanship and materials (Cochavi-Rainey 1999: 80-98; Moran 1992: 51-57). In particular the armour is listed:

> "One cuirass set, of bronze. One helmet, of bronze, [f]or a man. One cuirass set, of leather. One helmet, [of br]onze, for the *sarku*-soldiers. One cuirass set, of leather, for horses, set with *ri[ng]s* of bronze. Two helmets, of bronze, f[or ho]rses." (Moran 1992: 55; similar for Cochavi-Rainey 1999: 89).

The presence of both leather and bronze armour for both horses and men within the texts describing gold, silver, and other extremely high-status goods may indicate the relative value of the armour, possibly mostly for the effort involved in its construction (see Chapter 5.3). The amount of bronze involved in the construction of an entirely metallic armour would also not have been insignificant. Kendall (1974: 264) suggests that the plainness of the armour when compared to the other items in the inventory is notable. If one assumes that these coats of armour are not especially fancy, and there is no mention in the texts that they are, it would be reasonable to hypothesise that the armour was valuable mostly due to its construction. Its presence in the dowry inventory also suggests that it was an item particularly associated with elite society.

Armour also appears in EA 24: §26 111-118 (Moran 1992: 69):

> "[111]...But should in the future an enemy [112] *invade* my brother's land, (then) my brother writes [113] to me, and the Hurrian land, armour, and arms, [114] ... and everything concerning the enemy of my brother [115] will be at his disposition. But should, on the other hand, there be for me an ene(my) [116] -if only he did not exist! - I will write to my brother, [117-118] and my brother will dispatch to the land of Egypt, armour, arms...and everything concerning my enemy."

By this account, armour figured highly in at least the elite people's general view of the military. There is no specific mention of the other weaponry or other troops, but this may be implied in the statement above, especially if it is of a formulaic nature. The presence or absence of armour within the troops may have been an important factor. If one side has armour while the opposition does not, then the battle may be somewhat more likely to be won by those who are better equipped, and if armour was strictly the province of the palaces and the elite, it may stand to reason that it would be an element specifically requested by vassals who were facing a coming war

2.2.2.4) The Thutmosis III Megiddo booty lists

For approximately 20 years of his reign Thutmosis III [1504-1450 BC] led almost yearly campaigns into Asia. In the Karnak annals of his reign are the accounts of his campaign into Syria-Palestine, and armour is mentioned in his victory over the confederated forces at Megiddo in the autumn of the 23rd year of his reign (Pritchard 1969a: 235-236). After the battle was over, the booty was gathered, and eventually recorded on the Karnak temple. Included in the captured booty were a total of 202 coats of scale body armour, termed *mail* in the text. The relevant section of the list of captured booty is as follows:

> - "[List of booty which his majesty's army brought from the town of] Megiddo. Living Prisoners: 340. Hands: 83. Horses: 2,401. Foals: 191. Stallions: 6. Colts: —. One chariot of that foe worked in gold, with a ⌈pole⌉ of gold. One fine chariot of the prince of [Megiddo], worked in gold. [Chariots of the allied princes: 30]. Chariots of his wretched army: 892. Total: 924. One fine bronze coat of mail belonging to that enemy. One fine bronze coat of mail belonging to the prince of Megiddo. [⌈leather⌉] coats of mail belonging to his wretched army: 200. Bows: 502. Poles of *mry*-wood worked with silver from the tent of that enemy: 7. And the army of [his majesty] had captured [cattle belonging to this town] ------: 387. Cows: 1,929. Goats: 2,000. Sheep: 20,500." (Lichtheim 1976: 33-34, see also Pritchard 1969a: 237 [similar]).

As this text dates to the early part of the 15th century BC (Kendall 1981: 222, 1974: 263; Catling 1970: 447; Yadin 1963: 84; Lorimer 1950: 197), it is the earliest literary reference to scale armour being used in large quantities. The coalition of Syro-Palestinian rulers, who were under command of the Prince of Megiddo (Schulman 1995: 292), were defeated and, as was usual, yielded up a significant portion of the wealth of their territory. It is notable that for the two hundred coats of leather armour seized, there were only two coats of bronze armour, and at least one of those originated in the possession of royalty. With due caution, this ratio of one bronze coat of scale armour to 100 coats of leather armour may suggest a general picture of the scarcity of metal armour in the Late Bronze Age. Furthermore, the fact that two coats of metallic scale armour are mentioned in a list of booty which included thousands of livestock and almost a thousand chariots shows that armour was considered a valuable item. Although the Egyptian military texts are usually quite formulaic accountancy of the battle and of the things gained and lost (see Shaw 1996: 251, 253-254), Lichtheim (1976: 29-30) notes that the lists of seized goods from the Battle of Megiddo, and the numbers of items therein, are structured in a more factual manner. The numbers are lower and they do not appear to have the same bombastic tone, and as such are quite likely to be accurate lists of the goods seized rather than the typical New Kingdom Egyptian propaganda.

2.3) The Archaeological Evidence - Primary Collections

Presented below are, for this thesis, the three most important collections of scale armour found in archaeological contexts in the Late Bronze Age Near East. Further information on these sites, and others wherein smaller collections of armour scales have been found, is presented in Chapter 4, including discussions of the sizes and lacing patterns, and the quantities in which they have been found..

2.3.1) The Kāmid el-Lōz Armour

2.3.1.1) The Site of Kāmid el-Lōz and the Location of the Armour Within it

One of the largest collections of armour scales found in the Eastern Mediterranean was found during the excavations at Kāmid el-Lōz in the autumn of 1978. The armour was found in Rooms S and T in area IJ17 of the palace in the area termed the "Treasury" (named for the large number of elite items found therein). The vast majority of the armour was found in Room T, with only a single scale having been found in Room S. Rooms S and T actually served as burial chambers for a total of three occupants (described below). The armour was found within a secure, sealed context, but was not found all in one small area which would have been expected had the armour remained undisturbed subsequent to primary deposition. The remains of the armour was scattered throughout the room and it is thought that there was one complete armour corslet deposited which was eventually, in one or more stages, broken up and dragged across the floor of the room. Rooms S and T may have been left open to the elements, or left open for additional burials or ritual use, thus enabling the burial goods to be moved about either intentionally or unintentionally (Hachmann 1989: 119; Ventzke 1986). Many of the scales were found in a basin in the floor of Room T which was almost certainly covered by a wooden lid. The armour fragments found within the confines of the basin are thought to have initially rested upon the wooden lid, and when the wooden lid decayed, the artefacts fell into the basin, thus further scattering the armour scales from their positions at initial deposition (Hachmann 1989: 114).

Both Rooms S and T were likely intended as tomb chambers (Hachmann 1989:118). The human remains in Room T were laid out north of the basin, along the east wall. It is likely that the remains of the armour corslet are related to the skeleton of the adult male in the room. This interment is probably a "warrior burial" as there are numerous arrowheads, a dagger, and a khopesh sword all found in association with the human remains and the armour. There was a second skeleton in Room T, as well as one in Room S also laid next to the east wall, both of which were female children (Hachmann 1989: 114, 116, 118-119, 121). There was a considerable wealth of grave goods placed along with these two children (See Hachmann 1989), and it is this, in conjunction with the wealthy warrior burial and the location of the burials within the palace complex, that prompts Hachmann (1989: 121) to suggest that they may have been part of the ruling family of Kumidi.

2.3.1.2) The scale types and their appearances and characteristics

The armour find consisted of 184 complete and 157 fragmentary copper alloy armour scales along with approximately 36 to 40 small bronze wire staples or cramps which were found fused together in a corroded mass (Ventzke 1986: 161, 166, 169; Hachmann 1989: 111). Ventzke (1986) has constructed a typology in which the scales are divided into nine main types with several sub-types, based on the overall size of the scale and the pattern of lacing holes in the surface (Fig. 17). The following descriptions of the scale types are taken from Ventzke (1986) and Miron (1990).

Type I scales (53 examples) are slightly trapezoidal with a straight upper edge and a roughly right-angled point at the lower edge. Each scale has a pair of strengthening ridges, one running from the straight upper edge approximately three-quarters of the length slightly to the right of centre. The second ridge runs three-quarters of the length of the scale on the left edge again beginning at the straight upper edge. There are seven rectangular lacing holes in each scale; one pair just above the lower right corner of the scale to the right of the medial ridge, a second pair placed at mid-length and to the right of the medial ridge, and a third pair at the upper left corner of the scale between the medial ridge and the side ridge. There is a single hole to the right of the medial ridge at the upper edge of the scale between the strengthening ridges. The Type I scales have an average measurement of 23 mm in width at the top, 27 mm width at the shoulder before the scale tapers towards the lower point, and a total length of 87 mm.

Type II scales (70 examples) are rectangular with parallel sides and the lower edge formed into a right-angled point. Similar to Type I scales, there are two strengthening ridges, one in the centre of the scale, and the other on the left edge of the scale. The side ridge begins just below the pair of lacing holes in the upper left of the scale and continues along the left edge to the shoulder at which point the scale tapers to the lower point. There are seven rectangular lacing holes placed in a similar pattern to Type I scales. The Type II scales have an average measurement of 26 mm in width, and a total length of 62 mm.

Type III scales (12 examples) are rectangular with parallel sides and the lower edge formed into a right-angled point. There is one strengthening ridge placed centrally in the scale running from the straight upper edge approximately three-quarters of the length of the scale. There are seven round lacing holes placed in similar fashion to Type I and II scales except for the upper single lacing hole which is placed to the left of the medial ridge and forming a triangular arrangement with the upper left pair of lacing holes. The Type III scales have an average measurement of 24 mm in width, and a total length of 65 mm. The single Type IV scale is almost a mirror image of the Type III scales, but slightly shorter with measurements of 24 mm in width and 57 mm in length.

There are two Type V scales corroded together. The scales each have two medial ridges, one running just left of the centre of the scale for three-quarters of the length, the other running along the left edge of the scale the same length. The upper edge of the scale is lightly rounded and the lower edge is asymmetrically pointed with the point slightly to the left of centre. There are five rectangular lacing holes. There are two pairs of holes both to the right of the medial ridge, one just above the shoulder where the scale angles into a point at the lower end of the scale, the other pair is placed approximately at one quarter of the length of the scale from the upper edge. The single upper lacing hole is placed at the upper edge of the scale to the left of the medial ridge. The Type V scales have an average measurement of 25 mm in width, and a total length of 64 mm.

There are also only two Type VI scales. These scales are rectangular with a straight upper edge and a slightly asymmetrical rounded lower edge. There are two strengthening ridges, with the medial ridge placed to the right of centre and the side ridge placed on the right edge of the scale. Both ridges run from the upper edge to the shoulder of the lower point of the scale. There are five rectangular lacing holes, one pair of which is placed just below the centre of the length of the scale on left edge. The second pair of lacing holes are positioned towards the upper edge of the scale with one hole on each side of the medial ridge. The single uppermost lacing hole is positioned to the left of the medial ridge just below the upper edge of the scale. The two Type VI scales have an average measurement of 25 mm in width, and a total length of 57 mm.

The Type VII scales (6 examples) are slightly trapezoidal in form, and have straight upper and lower edges. Each scale has a pair of strengthening ridges, one placed slightly to the left of centre and the other on the left edge. The medial ridge extends approximately seven-eighths of the length of the scale beginning at the upper edge and the side ridge extends from the upper edge to within a few millimetres of the lower edge of the scale. There are seven rectangular lacing holes in each scale. One pair is placed approximately 22 mm above the lower edge of the scale to the right of the medial ridge. Another pair is also to the right of the medial ridge, just above the mid-length of the scale, and a third pair at the upper left corner of the scale between the medial ridge and the side ridge. There is a single hole to the right of the medial ridge at the upper edge of the scale again placed between the strengthening ridges. The Type VII scales have an average measurement of 24 mm in width at the top, 26 mm width at the shoulder before the scale tapers towards the lower point, and a total length of 90 mm.

There are two examples of the Type VIII scales which are noticeably different than the scales described above. The scales are very slightly curved in their shape, but have sides which parallel each other. The scales have a rounded upper edge and an approximately right-angled pointed lower edge. There is a pronounced medial ridge placed centrally on the scale and a vestigial side ridge on the right edge of the scale. The medial ridge runs almost the entire length of the scale and the side ridge extends from the termination of the radii at the point where the side of the scale begins at the upper edge to the lower shoulder where the lower edge of the scale begins to form into a point. There are five round lacing holes, one pair of which is at the lower left edge of the scale positioned where the scale begins to form into a point. The remaining three holes form a triangular arrangement at the upper right corner of the scale between the strengthening ridges. The Type VIII scales have an average measurement of 20 mm in width, and a total length of 56 mm.

Type IX scales (34 examples) are the smallest in the group from Kāmid el-Lōz. The scales have parallel sides and have a rounded upper edge and an asymmetrical pointed lower edge. The lower point is angled slightly to the right of the scale. The scale has a single strengthening medial ridge placed slightly to the right of centre which extends from the upper edge of the scale approximately seven-eighths of the length of the scale. There are five round lacing holes, one pair of which is in the lower left edge of the scale approximately 13 mm from the lower edge/point of the scale. The upper pair of lacing holes are positioned to the right of the medial ridge approximately 8 mm from the upper edge of the scale. The single uppermost lacing hole is placed to the left of the medial ridge almost in the centre of the width of the scale and close to the upper edge. The scales are 15 mm in width and 39 mm in length.

There are several sub-types within the Type I and Type II categories. These sub-types are based on slight variations in the placement of the lacing holes and slight variations in measurements. The lengths of the strengthening ridges varies a few millimetres, and the lengths quoted above are based on the type-scales for each of the Types mentioned. All of the scales, except for Type VII, have a slight to moderate proximal curve which is generally more pronounced in the area of the scale from the lowest edge of the strengthening ridges to the point of the scale. Type VII scales are completely flat save for the raised strengthening ridges.

2.3.1.3) Ventzke's hypotheses on the manufacture of the scales

The manufacture of the armour scales, as there is a very large quantity needed for the construction of a coat of scale armour, is an important issue to examine. Ventzke (1986: 174) suggests that some 1316 armour scales in a variety of sizes are needed to make even a sleeveless corslet and as many as 3003 for a calf-length full-sleeved coat, a considerably greater number than suggested for the coats of armour mentioned in the Nuzi texts (see Table 1). This will be discussed in more detail below, but it serves now to illustrate the need for a relatively fast method of production. Ventzke (1986: 167) has suggested that the armour scales were cut from a sheet of bronze rather than individually cast. He suggests that they were cut from a sheet because they are quite similar in size and appearance, but they are not identical which would be the result from casting. Another indicator that the scales were not cast is that the medial and side ridges are pressed into the scale from the back to front, rather than being cast in place. The strengthening ridges are not all of the same length which is what would be expected from a cast scale, and they are very evenly pressed or punched into the scale almost as though they were done with a machine (Ventzke 1986: 167).

Ventzke (1986: 167) attempted to replicate a selection of armour scales by first cutting blanks from a sheet of copper 0.6 mm in thickness. He used a short, sturdy punch to form the lacing holes, having laid the scale blank on a pliable (wooden) board. Ventzke suggests that the rectangular holes are punched, and the round lacing holes are perhaps formed partly by drilling and finished by punching. This process effectively formed the lacing holes and left a very slight raised edge around the holes on the back of the scales which is a feature also found on the armour from Kāmid el-Lōz. The placement of the lacing holes on the excavated armour scales is even enough that Ventzke suggests that they may have been punched according to a template. Ventzke (1986: 167) attempted several methods to form the medial ridges before finding a suitable procedure. The method that he suggests is that the blank armour scale was placed in a pre-formed set of grooves in a stone block and one half of the scale then held down with a single (or perhaps a pair of) third flat stones under pressure or tension. A single punch, or a pair, are then used to strike the ridges into the scales (Fig. 18). Ventzke notes that the grooved base needed to be of a very hard material, as the wooden base he initially tried proved to be too soft (Ventzke 1986: 167).

2.3.1.4) Ventzke's hypotheses for lacing the scales together

The positioning of the armour scales in a finished coat of armour at Kāmid el-Lōz was established by the find of 10 Type IX scales which were found corroded together in the location of their original form. It is from this that Ventzke bases his hypothesis on the method of fastening the scales into a coat of armour. Although the Type IX scales do not have a side ridge, Ventzke (1986: 168) suggests that the side ridges of the scale types in which they are present overlap to the point where the side ridge rests over the medial ridge of the scale next to it (Figs. 19c and 20b). This governed overlap of the scales presents a pattern of lacing holes on the obverse of the scales which Ventzke (1986: 168) has presented as the basis for his hypothesis on the method in which the scales are laced to the backing material (Figs. 19d and 20c).

Ventzke (1986: 168) states that according to the grid of lacing holes the laces run in both vertical and the horizontal directions. The lacing holes in the middle of the length of the scales correspond to the straight lines of holes in the backing material as presented in Figure 19d, holding the scales close to the backing material. The upper and lower pairs of lacing holes, and the single uppermost lacing hole, are laced together, attaching the horizontal rows of scales together. A lace passes through the backing material, and through the uppermost lacing hole, then runs a short distance down the length of the scale and through one of the upper pair of lacing holes on the scale next to it and through the corresponding lower lacing hole in the scale in the row directly above it. The lace then passes through the lacing hole next to it and back through the scale behind and below, around the edge of the scale next to it, and through the backing material again, before passing on to the next set of lacing holes (Fig. 19d). This rather complicated method of lacing the scales together will be challenged below in the examination of the armour from the tomb of TutʿAnkhamūn, which shows a much less complicated method of lacing the scales to the backing material.

It is most likely that the rectangular holes in the armour scales denote the use of leather laces while the round holes in the smaller scales (eg. Type IX scales), would have been laced with a fibre-based twine or possibly horsehair twine. The greater weight of the larger scales would necessitate a strong lacing material while the smaller scales would need a lacing of smaller diameter and decreased stiffness to provide greater flexibility (Ventzke 1986: 169-170). The linear edges of a rectangular hole would abrade a round lace, while the same is true for a rectangular lace threaded into a round hole. Furthermore, a rectangular lace which would pass through a round hole would be of considerably smaller dimensions (thickness and breadth), and therefore of lesser strength. Finally, it is not an easy task to make round leather lacing, nor is it easy to make rectangular or square cordage.

2.3.1.5) Ventzke's hypotheses on the overall structure of the Kāmid el-Lōz armour

Ventzke (1986: 169-170) suggests that the backing material for the Kāmid el-Lōz armour would have been made of stout leather, as a woven textile material would not be strong enough to support the weight of the armour scales. The more flexible armour protecting the shoulders would require a more flexible backing and smaller diameter lacing. Ventzke hypothesises that the backing material might have taken a form similar to a leather tunic constructed of several thong-stitched sections of leather. This would allow for greater ease of movement as well as facilitate quicker repairs. Ventzke (1986: 169) suggests a "carpet woven" or "firmly knotted" material (rather than standard woven fabric) for backing the armour, but does not fully describe what he means by these terms. Ventzke does not mention the possibility of several layers of textile serving as a backing material as is present in the construction of TutʿAnkhamūn's armour (as discussed below), which would provide the necessary strength as well as a greater amount of padding for the wearer. The greater amount of padding would serve the same function as the gambeson (a heavily padded shirt) did for medieval soldiers in helping to prevent the armour from chafing as well as helping to protect against blunt trauma injuries.

The placement of the particular types of scales in the armour is determined by their shape and the pattern they would take when laced together. Ventzke (1986: 172-173) suggests that the trapezoidal Type I scales when laced together would form a conical garment which would be suitable for forming the armoured skirt of a long or full-length scale armour (Fig. 21c), while the parallel Type II scales (which are also very slightly thicker than the other scale types) would be best used in forming a garment with parallel sides and would be best suited for the body of the armour (Fig. 21b). The Type IX scales would be best used to form armour for areas that required greater flexibility as the scales do not have side ridges which overlap and partially "lock" the scales together in their rows. This would provide an armour which could be better formed to the shoulders and upper arms (Fig. 21a) (Ventzke 1986: 172-173).

The amount of overlap of the scales governs the degree of protection that the armour will offer. According to Ventzke's (1986: 172-173, 179) hypothesis there is an overlay of four bronze scales protecting the body wherever Type I and Type IX scales are placed (Figs. 21a and 21b), and an alternating protection of 2 or 4 layers when the longer trapezoidal Type I and Type

VII scales are used (Fig. 21c). One disadvantage to the multiple layers of protection is that it greatly increases the weight of the armour, and it may be for this reason that the longer Type I and Type VII scales are used for the construction of the armoured skirts. Some added protection is also afforded by the slight proximal curve of all the scale types except Type VII. This curve functions both to allow the armour to form itself more closely to a horizontally curved surface (Fig. 19a) such as the shoulders, as well as provide some open space to allow the scales to be crushed against one another and lessen the effects of blunt trauma (Figs. 19b and 20a) should the wearer be struck with a crushing weapon such as a mace or club. The open spaces would also provide for slightly better air circulation which help to lessen the build up of heat (Ventzke 1986: 179).

2.3.1.6) Ventzke's analysis of the numbers of scales and the weights of the armour

To calculate the number of scales needed for the construction of a coat of armour from the scale types found at Kāmid el-Lōz Ventzke (1986: 171) began by determining the body size of the typical Late Bronze Age Kumidi warrior. He took the information on body size from the Persian cemeteries at Kāmid el-Lōz, and while they are later than the Late Bronze Age date of the armour, he states that the difference would not have been very great. Ventzke suggests that the individual warriors would average approximately 1.67 m in height and a body size equivalent to a European clothing size of 48 to 50 (Ventzke 1986: 171). This translates as a rather muscular, solid individual, which is what one would expect of a warrior who would have been accustomed to wearing, and fighting in, the heavy bronze armour.

Based on the structure of the sections of armour described above (see Figs. 19 and 21), the armour scales used to protect the arms and torso would be Type II scales, and Type IX scales for armouring the shoulders. Armour scales of Types III, IV, V, VI, and VIII would also be found in these areas based on the need to interconnect different sections of armour or provide localized areas of greater flexibility. The armoured skirt, if present in the coat of armour, would be fashioned from Type I and VII scales (Ventzke 1986: 173). Ventzke (1986: 173) presents four basic types of armour (Fig. 22a): Form A is a sleeveless vest protecting to the waist. Form B is a short-sleeved shirt which also protects to the waist. Form C is a short-sleeved armour protecting to the upper or mid-thigh. Form D is a calf-length armour again with short sleeves.

Ventzke (1986: 174) has proposed a system for determining the numbers of scales needed to fashion each of these armour styles. The four types of armour depicted in Figure 22a each have specific sections labelled within their outline. These sections each use different types of armour scales in their construction. Sections ***a*** and ***a1*** are formed from Type IX scales. Section ***b*** is formed from Type II, III, IV, V, VI, or VIII scales. Sections ***c***, ***c1***, and ***c2*** are fashioned from Type I or Type VII scales. Ventzke has depicted an armoured corslet that has been "taken apart art the seams" and has applied a 10cm squared grid to the resulting plan (Fig. 22b). From the grid that overlays the various sections noted above, he has determined the numbers of scales necessary for making each section. The tabulated results for each of the different styles of armour appears in Table 1. Each 10 cm square quadrant on Figure 22b will be formed of 72 Type IX scales, 22 Type II scales, or 12 Type I or Type VII scales after the overlap of the scales is taken into account (Ventzke 1986: 174).

Ventzke has calculated the weights for the armour scales taking into account their heavily corroded state. Only approximate average weights were possible due to the preservation of the scales in that there was rarely much metal remaining. On an average of relatively well-preserved scales Ventzke (1986: 176) has calculated the existing weights as follows: Type I scales on an average of 6 scales weigh 7.2 grams, Type II scales on an average of 5 scales weigh 7.2 grams, Type IX scales in an average of 3 scales weigh 1.5 grams. The single complete Type VII scale had a weight of 7.0 grams. The Type I and Type II scales are of similar weight, however the Type II scales are of smaller dimensions than Type I leading Ventzke (1986: 176) to suggest that the Type II scales were originally of slightly thicker bronze. Ventzke's replicas of the scales were made of 0.6 mm sheet copper and weighed 10.0 grams for Type I scales, 6.5 grams for Type II scales, 12.4 grams for Type VII scales, and 2.6 grams for Type IX scales. Replica Type IX scales made from 0.4 mm sheet copper weighed 1.75 grams each. To calculate the original weight of the bronze scales Ventzke (1986: 177) has added 25% to the weight of each scale to account for the loss of weight due to corrosion, and has subtracted 4.5% of the weight from each of the copper sheet replica scales to account for the difference in materials. Subsequent to this he has averaged the corrected weights of the two sets of scales (originals and replicas) to determine a reasonably accurate estimate of the original weights for each type of the armour scales. Type I scales have a corrected weight of 9.27 grams, Type II scales have a corrected weight of 8.37 grams, Type VII scales have a corrected weight of 10.27 grams, and Type IX scales have a corrected weight of 1.77 grams. Using the weights noted above and the numbers of scales calculated for each of the sections in the model he has created for the structure of the armour, Ventzke (1986: 178) has derived a series of weights for the four styles of armour which are presented in Table 1.

2.3.1.7) Ventzke's hypotheses on the use of the bronze staples/cramps

Found in Room T along with the armour scales was a large fused mass of bent bronze staples or cramps formed from 1 to 2 mm diameter bronze wire [Fig. 23]. The staples were found in association only with Type 1 scales, but even then, not in direct connection, as they were not actually holding the scales together. Ventzke (1986: 170-171) proposes that the staples may have been used to attach the scales directly to the backing material, but as none of the scales had the bronze staples running through their lacing holes, there is no way to prove this. It is possible that the staples were used to strengthen the armour at some points (Ventzke 1986: 171), presumably by fastening the scales together to provide a section of scales with less flexibility. The scales may also have been to attach some of the armour, perhaps the armoured skirts, to a belt.

The most acceptable hypothesis put forward by Ventzke (1986: 171) is that the staples were used when repairing a coat of armour. The staples would be used to hold the scales in place when the lacing was broken, with the ends of the broken laces knotted behind the scales. It is also possible that, as Ventzke states, the staples were used to hold larger sections of the backing material together when forming the garment to which the scales were attached.

2.31.8) Ventzke's hypotheses on the general use of the armour

The general function which the armour from Kāmid el-Lōz served, as with any other armour, was to protect the vital areas of the body. A variety of techniques were used in the construction of the Kāmid el-Lōz armour, but always to a specific set of "rules of construction" (Ventzke 1986: 179). The scales always overlap in the same fashion, and are arranged into rows next to one another as or before they are attached to the scale backing which is governed by the pattern of holes used to lace the scales together. The patterns used to lace the scales together are always such that the lacing is covered by the scales within the rows and by the overhanging row above so that it would be far more difficult for a weapon to damage the laces. The overlapping scales provide several layers of protection against penetrating wounds, but at considerable added weight. This weight, and the flexible, binding nature of the scales would however help to protect against blunt trauma.

Ventzke (1986: 180) notes that the armour from Kāmid el-Lōz is not entirely the same as that from Nuzi, but as will be discussed below, the "rules" which govern how the armour is constructed, based on the construction of Tutʻ Ankhamūn's armour (also discussed below) shows that there would not be many possible variations. The greatest variation would be in the length of the sleeves, or the method used to cover the shoulders in the event sleeves were not present and the length of the armoured skirt, if it was present at all. Three possible appearances of the armour are in Figures 24 and 25 which are artists interpretation in, respectively, Hachmann (1983: 149) and Healy and McBride (1992: Pl. I).

As only 184 scales and a further 157 scale fragments were found at Kāmid el-Lōz, the question arises as to what has happened to the remainder of the armour (Hachmann 1989: 118-119; Ventzke 1986: 181). It is possible that this armour is the remaining non-organic part of a composite coat of bronze and leather scales. It is possible, as Hachmann (1989: 119) has mentioned, that the burial chambers (Rooms S and T) were open to the elements, or at least "open" to be entered for ritual functions (eg. another burial) and at some point the armour was scattered about and some parts removed. Bronze scale armour would be very easily recycled as it is already composed of small parts which would easily fit into even a small crucible. Should the armour have been part of a trophy of war (Ventzke 1986: 182), only a section of it may have ever been present in the tomb.

2.3.2) The Nuzi Armour

2.3.2.1) The Site of Nuzi

All of the armour found at Nuzi came from the 1930 excavation season from the wealthy "suburban" houses some 300 metres north of the main site of Yorgan Tepe (Kendall 1974: 267; Starr 1939). The armour was found in the houses of Teḫiptilla, Šurkitilla, Ziki, and Prince

Šilwitešup and often along with it was found other military equipment. Most of the armour is now held in the collections at the Harvard Semitic Museum in Boston. By kind permission of the curator of the collection Dr. James Armstrong, an examination of the armour was undertaken at the museum in March, 2000. The remainder of the armour, specifically the "corslet" from the house of Prince Šilwitešup, is held in the Iraq Museum in Baghdad and is therefore currently inaccessible. Each of the armour scales has been given an accession number by the Harvard Semitic Museum, which shall be used below.

2.3.2.2) The Armour from Archaeological Contexts at Nuzi

2.3.2.2.1) The House of Teḫiptilla

This house was only partially excavated by Starr in his excavations in the 1930's. Within Room 19 in what appeared to be quite a large house were found 2 armour scales (numbers 1930.76.2 and 1930.76.10) [Fig. 26]. A large copper "pike" or spear head was found along with the armour scales as well as a few pottery store jars and smaller vessels. Aside from a strainer bowl found in Room 21, no other significant (!) artefacts were found apart from the 1000 or more cuneiform tablets (Starr 1939: 333-334).

2.3.2.2.2) The House of Šurkitilla

Attached to Teḫiptilla's house was another belonging to Šurkitilla, within which was found two rooms containing armour. Room 1, which only had a doorway to the outside of the house and did not appear to connect to the inside, contained 2 armour scales. Along with the armour were found an arrowhead, pottery, a grindstone and a stone tripod (Starr 1939: 335). The two armour scales from this room are now disassociated with the museum's accession numbers, but they may be numbers 1930.76.35 which is noted as "removed for conservation?" and 1930.76.36 [Fig. 27a] which is attributed to "room 93", the location of which is lost from the field notes.

The majority of the armour found Šurkitilla's house was found in Room 2 which was positioned next to Room 1 and connected to the main courtyard or the building. Ten "unassociated" (i.e. not attached to one another) armour scales were found along with a bowl, 2 whetstones, 2 copper nails, a copper sickle, 2 knife fragments, 3 spearheads, and 2 arrowhead

(Starr 1939: 335). Five of the armour scales are numbers 1930.76.3, 1930.76.4, 1930.76.5, 1930.76.7, and 1930.76.9 [Fig. 27b] with the remaining five being either in Baghdad or lost entirely, as they are not within the collection in Boston. It is also possible that scale number 1930.76.36 (as noted above, see Fig. 27a) is one of these missing scales, depending on the original location of "room 93" in the field notes.

2.3.2.2.3) The House of Prince Šilwitešup

According to Starr (1939: 337) only the palace was larger than Šilwitešup's house which was not fully excavated. Within his house were found a large number of both texts and artefacts, including an indeterminate number of armour scales (it is not possible to determine this from either Starr's excavation notes or his published works). Room 23 contained a stone duck-shaped weight, a marble staff-head, and a marble mace head, pottery, and an armour scale which is now in Baghdad [Fig. 28a] (see Starr 1939: pl. 126 O).

Room 18 in Šilwitešup's house contained a large quantity of pottery and glass beads, two smaller armour scales which are not in the museum (or are misidentified) and three large rectangular armour scales (1930.76.8) [Fig. 28b (Starr 1937: Pł. 126L) and Fig. 28c (as the armour now exists)]. A section of 36 armour scales which were fused together, and are now in Baghdad [Fig. 29], were found under a storage jar. These scales were fused together in two rows of 18 (Kendall 1974: 271) scales each and preserve the overlap to a degree. The two rows are fused together with the rounded lower ends of the scales touching, which as will be described below, suggests that the two rows were not attached to one another by having been stitched to a backing material. Room 2 also contained a few scattered scales whose location is now unknown.

2.3.2.2.4) The House of Ziki

Room 33 in the House of Ziki yielded two armour scales the location of which is now unknown. A selection of pottery was found along with a few cuneiform tablets and 4 stone duck-shaped weights. The majority of the armour was found in Room 34 along with a large selection of military equipment and other artefacts including pottery. Due to the varied nature of the finds Starr (1939: 347) has called this room a "general store-house" rather than the "household armoury" questioning both the presence of the pottery and what role it would serve in an armoury. Five armour scales with rounded lower ends were found along with 26 arrowheads of various shapes and sizes, 2 knives, and a variety of metal tools. Along with this were found several masses of fused copper (Starr 1939: 345-247). There were also 54 Type 1 scales [Fig. 30] (see discussion below) along with fragments and fused masses of copper containing at least as many more scales of this type (Kendall 1974: 268), some of which are numbered 1930.76.11, 1930.76.12 and 1930.76.14 to 1930.76.34 inclusive.

The presence of remains of armour in the elite houses at the city of Arrapḫa is not at all surprising given the number of coats of armour issued to various people in the Nuzi Texts as described above. Starr (1939: 347) suggests that the comparatively large number of scales found in the House of Ziki was due to the fact that this room burned before it could be looted. He suggests that the fused masses of copper were the result of an exceptionally hot fire which resulted from the burning of the "unknown combustibles" that must have been present in the room, as a burning roof would not have been hot enough (Starr 1939: 347), although an exceptionally windy day might have promoted such a temperature. To this Starr adds the possibility that the number of finds from the House of Ziki reflects what other rooms in the elite houses may have contained had they not been looted. This hypothesis is reasonable and may account for the relatively low numbers of armour scales found in a site which in the 15th century BC, according to the Nuzi texts, must have had thousands if not tens-of-thousands of individual armour scales (formed into coats).

It is hypothesised by Starr (1939: 476-477) that the uniformity of the scales in the "corslet" found in the House of Prince Šilwitešup suggests that the variety of sizes of the other scales found in the site would mean that scale armour was common even though few scales were found, and that it was evenly distributed. This is possibly true, but likely only for the elite members of society, and perhaps those citizens that held higher military positions. It is unlikely that much scale armour was ever present in the non-elite domestic areas on the main tell itself due to the primary association of the armour with the chariotry, and the association of the chariotry, generally, with the elite of the populace (see Chapter 5.1).

2.3.2.3) The Armour Found at Nuzi

<u>Note</u>*:* The surviving scales in the collection at the Harvard Semitic Museum are listed by their accession numbers in the database, where a more detailed description of each individual scale, where possible, may be found.

The Nuzi texts suggest two basic types of armour scales: large scales for the body and small scales for the sleeves, both styles of which have been found in Starr's excavations at Nuzi, and have been discussed above. As well as the size of the scales, there are several distinct types of armour found at Nuzi. Kendall, in his 1974 dissertation, has categorized the armour at Nuzi into seven types based on dimensions, the pattern of lacing holes in the scales, and their overall form. Type 1 scales (Kendall 1974: 268) are different from all the rest of the scales as they are rectangular, they have a rounded protrusion at one corner, and they are unperforated [Fig. 30]. Kendall's (1974: 271-276, 285-286) Types 2 to 7 [Fig. 31] are all similar in that they resemble, to a degree, all the other armour scales that are discussed in the present text. They are all greater in length than width, have a medial strengthening ridge, and are perforated to accept the laces which tie them into rows prior to their being attached to a backing material.

The Type 1 scales from the House of Ziki [Fig. 30] are all of similar enough size to be used in the same garment, but are not identical contra Kendall (1974: 268). Each of these scales is has an off-centre medial strengthening ridge and a rounded protrusion at one corner. They measure approximately 7.0 cm in length by 3.2 cm in width and are an average of approximately 2.5 mm in thickness. Many of the Type 1 scales have sections which are missing, but can be identified by their overall form and lack of lacing holes. These scales are certainly cast rather than cut from sheet metal, as the medial strengthening ridge is raised on the face of the scale, but has no equivalent groove on the obverse. This strongly suggests that these scales have been cast in this manner, and that this form of armour scale, if indeed it is armour, was produced in a different manner than all of the other perforated scales, at least those for which information exists, that are presented in the database.

The identification of the type of armour that may have been formed from Type 1 scales is problematic (Kendall 1974: 269). Starr (1939: 480) suggests that they were held to a leather or fabric backing by passing a strong cord through the backing, across the scale, under the protrusion, into and back out of the backing material, and on to the next scale. This would only result in a form of armour that would fall apart quickly in use (Kendall 1974: 269). If the medial ridges serve the same function with these scales as for the standard perforated scales, they would have prevented the scale from sliding past one another when laced together. In this case the scales appear to have overlapped by approximately 1 cm (Kendall 1974: 269) by the placement of the medial ridges on the face of the scale. It would be more likely that this style of scale was placed in pockets or held between strips of leather (Kendall 1974: 269-270) with the protrusions serving in some method devised to keep the scales equidistant. Kendall continues by suggesting that the finished armour may look something akin to the lamellar armour of the Assyrian period [Figs. 32a and 32b].

The Type 2 scales at Nuzi are represented by the "corslet" found in the store jar in the House of Prince Šilwitešup. The lacing pattern in one row is opposite that in the other row. Each scale is approximately 10.8 cm in length by 4.3 cm in width and approximately 3 mm in thickness. Each of the scales weighs approximately 37 grams. The scales have one edge which is slightly curled towards the face of the scale while the other is curled slightly to the back (Kendall 1974: 271). As with all the other armour scales, there is medial strengthening ridge on the face which has been embossed from the back.

These scales are the largest found in the Late Bronze Age Middle East except for the scales found at Malqata in the Theban Palace of Amenhotep III. Kendall (1974: 272) states with certainty that these are the "...large copper scales of the body..." as mentioned in the Nuzi texts. With scales of this size, there would be less effort involved in manufacturing the armour as there would be fewer scales to make, and fewer to lace together. The only sacrifice in this technique would be that the armour would be less flexible.

The Type 3 scales are quite similar to the Type 2 scales only slightly smaller at approximately 10.2 cm in length, 4.5 cm in width, and averaging approximately 1.6 mm in thickness. As these scales were found in Room 34 of the House of Ziki and Room 2 of the House of Keltešup (possibly the House of Šurkitilla) (Kendall 1974: 273), they probably originated in a different coat of armour than the two rows of scales in the Prince Šilwitešup's house which would account for the slight difference in size while maintaining a relatively standard size.

The Type 4 scales are similar to Type 3 but are slightly smaller [Fig. 31]. Kendall (1974, 1981) does not provide any measurements for these scales, but does state that they are perforated only on to one side of the medial ridge and suggests that they may have been used to reinforce the armour where the "large scales" were too large (Kendall 1974: 275). Scales with this lacing pattern are also found in the armour from the tomb of Tutʿankhamūn (discussed below) and are perhaps better suited to being laced over a deeply curved area such as the shoulder.

The Type 5 scales are the smallest scales from Nuzi and measure approximately 5 cm in length and vary between 3.0 and 3.2 cm in width [Fig. 31]. As with several of the other types of scales they are approximately 1.6 mm in thickness. These scales are perforated in the same pattern as the Type 3 scales and have been found in each one of the wealthy suburban houses. It is likely that they were used for "auxiliary" parts of the corslet, presumably sleeves and gorgets, and perhaps the helmets as well (Kendall 1974: 275).

A single example of the Type 6 scales was found in Prince Šilwitešup's house (see Fig. 31). The sides of this scale are not parallel and the lower edge is pointed rather than rounded as with all the rest of the standard armour scales at Nuzi. The scale is quite large, being 12.7 cm long, 3.2 cm wide, and 2.4 mm thick. Also, the scale is quite heavy at 32 grams. The lacing pattern is again the same as the Type 2 scales. It is possible that this type of scale was used in some of the helmets where a relatively small number of scales is used (Kendall 1974: 275-276; Starr 1939: 341-477) or as one of the scales for the body or armoured skirts. A similar scale type was found in the armour from Kāmid el-Lōz (Type 1 scales) [Fig. 17] which Ventzke (1986: ???) believes was used in the manufacture of the armoured skirts.

Three large scales were found in Room 18 of Prince Šilwitešup's house which have been classified as Type 7 scales (Kendall 1974: 285) [see Fig. 31]. These scales measure 11.1 cm in length, 6.5 cm in width, and 1.7 mm in thickness. Kendall (1974: 285) has suggested that these scales were too large for human armour, and were likely intended as horse armour. The lacing holes through these scales is rectangular which would suggest leather thongs rather than round fibre cord (as all the other perforated scales from Nuzi have round lacing holes). The scales could possibly have replaced the sections of a human armour covering the chest and back, but would result in a considerable decrease in mobility. Due to the larger size however, they would certainly decrease the time needed to manufacture enough scales to form a complete armour. There are no archaeological parallels to this type of armour in the Late Bronze Age, nor are there any depictions which would suggest armour scales of this type had been used in human body armour, so it is therefore most likely that these scales were from, or intended for, a coat of horse armour. Reference is made to horse armour in the Nuzi texts (see HSS XV: 4 (Kendall 1974: 348-350) and Chapter 2.2.1.4), so it may be this form of bronze scales that were used in the construction of the coats of horse armour.

2.3.2.4) The Hypothetical Weights of the Complete Coats of Armour

On Table 1 are listed the hypothetical weights proposed by Kendall (1974: 276-278) for a variety of coats of armour mentioned in the Nuzi texts. Kendall (1974: 276) has averaged the weights of the amour scales from the excavations at Nuzi based on his classification of what are "large" and "small" scales and applied these to the texts which list the numbers of scales in a coat of armour. The "large" scales from the excavations average out to approximately 33 grams each while the "small scales" average out to 12 grams each. Table 1 show the range of weights possible for the armours listed in the texts with the assumption that all the scales listed were made of copper or a copper alloy.

A weight of 16.548 kg for the lightest armour listed on the table would be quite manageable, whereas the heaviest at 25.854 kg would be quite cumbersome. The weights suggested for the coats of armour at Nuzi are similar to those suggested by Ventzke (1986: 177-179; see also Table 1), and suggest that there is no standard size or form for the armour from Nuzi. The wide range of numbers of scales listed in the Nuzi texts would also suggest that there were several different forms of scale armour available to the soldiers. Kendall (1981: 201) states that there are a total of 15 different styles of armour listed in the Nuzi texts. The question that arises from this is why fifteen different types were needed. It might be hypothesised, as in the section above detailing the Nuzi texts, that different tasks required different armour, and the different social status of the recipients of the armour would also govern their form and construction. Due to the cost of the material and the labour involved in manufacturing the armour it is probable that only the elite at Nuzi wore the armour. As a comparison to the metal arrowheads that were found in many private houses, armour was only found in a few elite dwellings, which would suggest that heavy metal scale armour was the province of the elite and wealthy (Kendall 1974: 279).

2.3.2.5) Kendall's (1974) Hypothesis on the Lacing of the Armour Scales

Starr (1939: 477) proposed that at least two methods of lacing the armour scales together existed. Starr did not include any diagrams of these, however the first hypothesis reads as though it is almost exactly the same as one lacing pattern which exists in the armour from Tutʿ Ankhamūn's tomb. Even though Starr came very close to identifying the actual methods of lacing the armour scales together, he suggested that the armour did not hang from the body as in the contemporary depictions. He suggested that the armour scales were fastened side-by-side together into rows and these rows of scales would then be hung vertically on the backing material. This would result in an appearance of the armour scales running perpendicular to all of the depictions of scale armour from the Late Bronze Age (i.e. the armour depicted in Kenamun's tomb Figs. 7 and 8). Starr based this hypothesis on the slight proximal curve that each of the scales has, with the basis for his argument that the scales would better fit to the contours of the body if they were fastened in this manner.

The second suggested possibility for lacing the scales together involved lacing the armour scales together in rows, and then lacing another row such that what is now known to be the outer surface of the scales faced inwards. Starr (1939: 478) suggests that these scales would be turned "...back to belly..." and overlap, providing four thicknesses of scales. Starr correctly notes that this would use a huge number of scales and end in a coat of armour of great weight. Starr does, eventually (1939: 478-479) discard this hypothesis. The style of lacing which he suggested is more in keeping with lamellar or cataphratic construction where the scales are laced together, but are not laced or stitched to a backing material (see Robinson 1967).

The actual method of lacing together the armour scales from Nuzi would be the same as that for Tutʿ Ankhamūn's armour (discussed below) [e.g. Figs. 44 to 47]. Kendall (1974: 272-273), in the absence of the latter information, has suggested two lacing patterns (see Fig. 33). These treat each scale as a single element laced to the backing material. In this form, any repairs would be labour intensive, requiring the relacing of several scales to replace one. With lacing pattern A should one scale need to be replaced, scales to each side would have to be loosened and re-laced. In pattern **B**, scales to each side and in the rows above and below would need to be loosened and relaced. In both of these patterns, depending where the damaged scale was in relation to the knots in the lacing, it might be necessary to relace a fairly large section to make a small repair.

Starr (1939: 342) suggests that the "corslet" from Prince Šilwitešup's house may have been hidden within the storage jar by the occupants of the house as they fled the city. He later (Starr 1939: 479) suggests that in a siege situation, all useable armour would have been made use of, and that perhaps the armour in the jar was a partially finished coat. It may also be reasonable to suggest that the two rows of scales and the few other non-associated scales, as they are not in relation to one another as would be expected in a finished coat, may have been a form of "repair kit". An idea which may further the "repair kit" hypothesis are the bits of wire found in Room 34 of Ziki's house. Although the wire was not found in direct association with the armour scales (Starr 1939: 347), it is parallelled by the wire found along with the armour from Room T at Kāmid el-Lōz as discussed above. These bits of wire, though their characteristics are not noted by Starr or Kendall, may have served in a similar fashion to the bronze staples from Kāmid el-Lōz.

2.3.2.6) Conclusions

From the Nuzi texts and the examination of the armour above, it seems quite safe to assume that the more complex the armour was at Nuzi, the more closely linked to the elite it was. As no examples of organic armour were found at Nuzi no comparisons may be made between the textual references to the leather *tarkumazi* armour or leather scale armour, and as such, a complete picture of the appearance of the armour available to the soldiers at Nuzi is not available. The section below will deal with the corslet of rawhide scale armour found within the tomb of

Tutʿ Ankhamūn, and subsequent to this, a better understanding of organic armour will be achieved.

2.3.3) The Scale Armour Cuirass from the Tomb of Tutʿ Ankhamūn

2.3.3.1) Location of the Armour, Find Location, Excavation and Museum Numbers

The cuirass of leather scale armour was found in 1923 by Howard Carter during the clearance of the annexe of tomb number #62 in the Valley of the Kings at Thebes in Egypt. During the clearance of the tomb, the armour was assigned excavation number #587a (as it was found within the wooden box numbered #587). At present it is stored in Gallery 3 on the first floor of the Egyptian Museum, Cairo, and has been assigned accession number #62628. The armour is not on display to the public. By gracious consent of the staff of the museum and Dr. Gabala (Head of the Egyptian Antiquities Service), an examination of the armour was made possible.

The examination of the armour found in the tomb of Tutʿ Ankhamūn was conducted on four days (8/10/1998, 10/10/1998, 12/02/2000, and 19/02/2000). The examination of the armour was conducted in one corner of Gallery 3 (first floor) of the Egyptian Museum, Cairo next to the cupboard in which it is stored. Due to concerns for the preservation of the armour on behalf of Dr. Mohammed Saleh, Dr. Mohammed el-Shimy (both now former Director Generals of the Museum), and Miss Sohir el-Sawi (Head in Charge of the First Section), the examination of the armour was restricted to a total of one hour on each day. This situation was such that an in depth analysis of the armour was not possible. Photographs were taken as a record of the armour to enable further study at a later date. The extreme fragility of the armour and the time constraints were such that only cursory measurements of the armour were possible.

2.3.3.2) Account of Carter's original observations

Upon writing the texts describing the Tomb of Tutʿ Ankhamūn Howard Carter made mention of the armour in only one paragraph, as follows:

> "Another form of defensive armour was a crumpled-up leather cuirass that had been thrown into a box. This was made up of scales of thick tinted leather worked onto a linen basis, or lining, in the form of a close-fitting bodice without sleeves. It was unfortunately too far decayed for preservation." Carter 1933: 143.

The Griffith Institute now holds the original card catalogue written up by Howard Carter during the progress of the clearance of the tomb. The card suggests that some attempt at conserving the armour did occur and records the solution used to preserve the leather:

> Treatment of cuirass:
> Amyl Acetate and Acetone mixed in equal quantities (volume)
> Add celluloid to give a 2.5% solution.
> To this add pure castor oil and shake up until no further solution.
> Wash finely with celluloid solution if necessary

2.3.3.3) Description of the Armour (as it now exists)

Harry Burton's original photograph (Fig. 34) of the armour *in situ*, prior to it being removed from the box, is without a scale. On examination of the armour, it was found that the photograph is approximately 1:2 or perhaps 1:2.5, much smaller than had been initially assumed. In Burton's original photo the back of the armour is most likely what is shown. The square-cut high collar shown at the top centre of the photograph would be suitable for the back of the armour, but somewhat too high for the front as it would tend to choke the wearer.

The armour, as Carter (1933: 143) stated, is in a very poor state of preservation. It is now in a very fragmentary state, obviously having seen rough handling in the intervening 78 years. The original photograph by Harry Burton shows the armour in what appears to be a complete and unbroken state, although it was crumpled up. The armour as it now exists is in much poorer condition and appears to have been broken up at some point after it had been removed from the tomb, possibly during removal from the wooden box in which it was found. The larger pieces of the armour are now stored in a box (Fig. 35a), with the loose scales stored in a small tray (Fig. 35b). On examination it appears that approximately one half of the total quantity of the armour is missing, and only one large section of armour remains in which the scales are still laced together and stitched to the linen backing (Fig. 36). This assumption is made by a visual assessment of the quantity of scales and pieces of armour that are now in storage in the Egyptian museum, and this quantity is not sufficient to form a complete cuirass. The staff of the museum do not know what has become of the missing sections of armour, nor was a search of the relevant storage areas successful. It is possible that some sections of the armour were discarded as they were deemed unworthy of preservation.

There is no order to the placement of the loose scales in the tray which might suggest from which sections of the complete armour they may have come. There are a few scales in the box which are still attached to one another, but without the linen backing. The study of these pieces allowed the lacing patterns to be determined without attempting to separate the linen from the scales in the larger pieces, and shall be discussed below. The second box of armour contains mostly larger, relatively intact sections which provide some information as to what the finished appearance of the cuirass may have been.

Most of the larger pieces of the surviving armour are backed with six folds of linen as described by Carter (1933: 143). There are traces of very thin blackened leather on the inner surface of the linen backing which may have originally been a final undercoat. This is similar to a small section of the smaller cross-laced scales, here hypothesised to have protected the shoulders, which are only backed by a very thin layer of red coloured leather. This will be discussed below.

Some of the larger pieces of the armour are adhered to the bottom of the box, probably as a result of the solution used in conservation. It was not possible to lift these pieces out of the box for examination due to their extreme fragility.

2.3.3.4) Description of the Materials Used in the Manufacture of the Armour

Initial examination of the armour scales in November, 1998 suggested that the scales were made of alum tawed leather (see Appendix 2), a process whereby the hide is cured with a solution of alum and common salt (see Waterer 1956: 150, 154-155). All of the scales are of a pale to mid-yellow colour on the suede side while most are painted or lacquered on the epidermal side (the outward face of the scale). A re-examination of the armour in February, 2000 indicated that the scales are almost certainly made of rawhide. In the cases where the paint had flaked away from the face of the scale, it was possible to check to see if they were translucent. This was done by holding a scale up to the light of one of the portable photography lights, thereby establishing that the scales are indeed translucent. To the best of the author's knowledge, the only hide product that is translucent is rawhide, as every other tanning or tawing process renders the hide opaque (see Appendix 2). As no samples of the armour were obtained for analysis, it is not possible to conclusively prove that the armour scales are made of rawhide, nor is it possible to be certain of the type of animal from which the hide came. The thickness of the rawhide, varying from approximately 1.3 to 2.5 mm, might suggest sheep or goat hide rather than a larger animal (e.g. cattle) (Barry Birkin, J. Clayton & Sons Tanneries, Ltd., pers. comm.). The laces have a different, more fine-grained appearance and are not translucent, suggesting that they have been subject to a different tanning process. There is no evidence, either in Carter's (1933) text and excavation notes or in the author's examination, to suggest that any metal was used in the construction of the armour.

One of the larger sections of armour has a few scales which were bent where the armour was folded (Fig. 37). This appears to be the result of the armour being stuffed into the box without care. The bending also suggests either that the scales were once somewhat more pliable than they are now, or that the armour had been stuffed into the box with considerable force. It was not possible to determine the level of pliability in the scales when they were first manufactured, but as they all appear to be made of rawhide, it is likely that they were not "soft", but rather they were tough enough to withstand being bent out of form and then straightened. The bends in the scales that now exist are surely the result of the armour being forced into one position for almost 3,400 years. As the rawhide hardened over time, the bends in the scales were permanently set.

Some of the smallest scales, as described below, are cross-laced and attached only to a thin leather backing, with no linen present (Fig. 38). This leather backing is 0.6 mm in thickness and is painted or dyed red to match the colour of the scales, while the suede side is a yellow-brown colour. The paint, or dye, is flaking away from the leather in a few small areas. The scales and this leather backing are attached such that the suede sides of both are together. Although this leather is now quite friable, it is obvious that it was originally quite soft as there are many fine folds and creases present. As with the rest of the armour, it was not possible to secure a sample of this leather for further tests, hence no assumptions as to the species from which this leather originates have been made. There are traces of what is probably this same type of leather on the inside of the linen backing of the larger pieces of armour (Fig. 39). These traces of leather are blackened and appear similar to the fused masses of scales described below.

Most of the rawhide scales of the armour are affixed to a linen backing which is made up of six layers as Howard Carter notes (1933:143). The linen is a yellow coloured cloth of a very fine weave, approximately 64 threads per inch (as examined with a "linen tester" magnifying loupe) and is most likely in the un-dyed natural state. The weave of the linen is a standard simple cross-weave pattern. Due to the delicate and fragmentary nature of the armour, it was not possible to examine each of layers of linen to determine if different weaving patterns were used for different layers.

On the inner face of the linen are traces of what appear to be very fine leather. This would have provided a soft, smooth layer against the body which would help prevent chafing. This appears to be the same type of leather used as a backing for the smallest scales discussed below. This leather is badly decomposed, and is now blackened. It may have originally been painted or dyed red, as was the backing for the small scales (Fig. 39).

The edges, or hems, of some sections of the armour survive. Mostly, these are sections of small scales where the thin leather backing survives. There are three slightly different forms of edge that survive. In the first type the edges were formed by folding the thin leather backing over a 3 mm diameter cord and stitching the fold down with two rows of stitching (Fig. 40a). The second method of forming the edge of the armour involved folding over the thin leather backing as with the first method, but without the cord, and stitching it together with two rows of stitching (Fig. 40b). The third method of forming the edge of the armour involved much the same approach, but included what appeared to be both a leather lace and a cord in the fold before the layers were stitched together with the typical two rows of stitching (Fig. 40c).

2.3.3.5) Description of the Scales

The workmanship of the armour is very fine, as one would expect in an item from TutʿAnkhamūn's tomb. All of the scales, even the smallest, have a medial strengthening ridge, and most of them taper slightly towards the top edge. The majority of the scales were probably originally a very definite red colour, but now only some retain their original vibrant colour while many are varying shades of brown. Many of the scales have a high lustre to their surface, especially those which are the brightest shade of red, and it is unclear whether this is the appearance of the original finish, or the result of the solution employed during conservation of the armour. Only one side of the scales have been tinted with some form of paint or lacquer, with the suede side of the scales (facing the linen backing) remaining their natural colour.

Most of the scales in the armour, both larger and smaller examples, have a distinctly asymmetrical shape. This would, when a row of scales was laced together, allow the points of the scales to have an evenly spaced appearance (Fig. 41). This would not have a functional benefit, but rather would only enhance the appearance of the armour. Furthermore, many of the smaller scales have a pair of holes at the tip of the scale. These holes are for cross lacing the scales in the absence of the linen backing to which most of the scales in the armour were fixed as in Figure 38.

In examining the armour, a representative sample of fourteen scales was measured and weighed to establish a basic set of data on length, width, thickness and weight. The scales are measured for total length, width at the widest point, width at the narrowest point, thickness and weight. The graphics included with the measurements are an accurate representation of the size of the scales and give a general representation of the location of the lacing holes and medial ridge. Although no photographs were taken of the scales that were measured, a representative selection of similar scales is shown in Figures 42a and 42b. The various patterns of the lacing holes in the scales are shown in Appendix 3.

The medial ridges on the scales protrude from the face of the scale with a corresponding groove or channel in the back of the scale. On the smaller scales the medial ridges stand proud of the scale face a distance of 1.3 mm to 1.5 mm, and on the larger scales approximately 1.9 mm. For the depictions of these scales, see Appendix 3.

2.3.3.6) Methods of Lacing the Scales

Due to the present state of the armour, it was difficult to determine the lateral alignment of the rows of scales. There are two possible alignments that may have been used, as shown in Figures 43a and 43b. The slight lateral displacement of the scales in Figure 43b may have helped to prevent the point of a weapon or an arrowhead from passing between the vertical edges of the scales. This slight variation would, however, probably not make any considerable difference in use.

Many of the scales have three pairs of lacing holes (e.g. lacing hole pattern 5 in Fig. 72) in which three laces hold the scales together in long rows. The first lace, passing through the uppermost pair of holes, passes from the front to the back of the scale through the right-hand hole, and from the back to the front through the left-hand hole. The lace then travels to the left to the next scale where this is repeated again (Fig. 44a). The lace passes across the faces of the scales, but is protected from damage (e.g. in battle) by the next row of scales above which will overlap the lower row at least as far as its uppermost row of lacing.

The two pairs of holes which are positioned just below the centre of the scale to either the left or right edge are laced with a pair of laces. The process is similar to that described for a single pair of holes, but the upper and lower laces from one scale cross over one another to pass through the opposite pair of holes in the next scale (Fig. 44b). The laces begin at the back of the scale and pass through the right-hand hole to the front of the scale, and back again through the left-hand hole of that pair, with the result that the lace passes across to the next scale on the back of the scales.

For scales which have only one pair of holes below centre to the left or right edge (e.g. lacing hole pattern 3 in Fig. 72), the lacing is the same for lacing the upper pair of holes as it is for the scales described above. The single lower pair of holes is laced in a similar fashion to the lower two pairs of holes as described above (Fig. 45a), where the lace begins at the back of the scale and passes through the right-hand hole to the front of the scale, and back again through the left-hand hole of that pair. The lace then passes on to the next scale and the process is repeated (Fig. 45b). These processes are repeated for the number of scales necessary to make up the length of row desired.

Many of the scales examined have the pairs of lateral lacing holes all to one side of the scale as in lacing hole patterns 11, 12, 13, and 14 in Figure 72. The laces are threaded through the lower pair or pairs of lateral holes as in scales with lacing hole patterns as described above (e.g. lacing hole patterns 7, 8, 9, and 10). The upper pair of holes, on the same side as the lower pair or pairs of holes, are laced in the same fashion, with the lace beginning on the back of the scale and passing through to the front, and then through to the back at which point it passes on to the next scale. This style of lacing may allow a greater degree of curvature in the finished armour and thereby enhance mobility.

Some sections of the armour have laces which join the lower points of the scales together (Fig. 46 and i.e. lacing hole patterns 7 and 9 in Fig. Chapter 72). These laces, passing through the pairs of holes in the lower points of some scale types, and pass over the faces of the scales. These laces allow the rows of scales to remain attached to one another without the use of a linen backing material. Two laces pass through the lower point of each scale and join to the lower points of scales in the rows both above and below. From any scale in a section of the armour laced in this fashion, given that it is not on the edge of the section, the two laces will meet at the points of scales in the rows above and below, skipping either one (Fig. 46) or two (Fig. 47) scales between those through which the laces pass. It was not possible to establish how the lacing pattern ends at the edges as no examples of the lateral edges of sections of armour laced in this fashion survive.

Concerning the attachment of the scales to the backing material, it was possible to examine only the uppermost row of scales which are attached to the thin leather backing with thin fibre cord as described below. As it was not possible to separate the scales from the leather backing, it was not possible to determine whether or not they are attached at all. With the complex cross-lacing it is possible that the whole section of scales is only attached to the leather backing at the uppermost row of scales, leaving the leather backing free of the scales to afford greater mobility.

This form of lacing allows greater movement between the rows of the scales, allowing them to concertina in both the X and Y axes. This form of lacing would most likely have been used in an area where extra flexibility in the armour was necessary, or in an area of greater curvature such as over the curve of the shoulders. With this in mind, most of the scales in TutʿAnkhamūn's armour laced in this fashion are the small scales as described above, although some of the larger loose scales also have the pair of holes in the points of the scale which would facilitate this cross-lacing. In the cross-laced sections of armour that were examined, when viewed from the back, it appears that the laces which pass from left to right always underlay the laces which pass from right to left.

The lowest hem of the armour is evident only in one section of small scales. The scales are laced together as described above with a lace passing through the single lacing hole in the point of the scale (i.e. lacing hole pattern 17 in Fig. 72) serving to hold the scales together. The lace passed through the one scale from back to front, passes to the next scale where it passes through the hole from front to back, and then on to the next lacing hole (Fig. 48).

There are three materials used to fix the rows of scales to the linen or leather backings. In the sections of armour formed of the larger scales leather laces, much the same as those used to lace the rows of scales together, are used to attach the rows of scales to the linen backing. These laces are passed through the uppermost hole in the scale and through at least some of the layers of the linen. It was not possible to separate the layers of linen due to their fragility, so it was not possible to establish how many layers of linen the laces passed through. The laces did not, however, pass through all six layers. In the few short sections of rows of mid-sized scales which still exist, the rows are attached to the leather backing with what appear to be laces made of either sinew or rawhide which are approximately 0.8 mm in diameter. The rows of small scales are attached to the thin leather backing with fibre cord of 1.0 mm diameter. In all the sections of armour examined, the laces used for attaching the rows of scales pass through the uppermost hole of every third scale. This would provide both a firm attachment of the rows of scales as well as facilitate more rapid repair in the case of the armour being damaged.

The laces on the mid-sized and larger scales are fairly uniform at approximately 1.0 mm thick and 2.5 mm wide. It was difficult to find laces that were suitable to measure due to their extreme fragility. The laces that were measured were on the largest section of scales (Fig. 36). As with many of the scales, most of the laces are a red colour, but some are brown to black, probably as a result of the heat and humidity fluctuations that resulted in many of the scales deteriorating into the fused and blackened masses.

During the examination of both the armour and Burton's original photo (Fig. 34), it was found that some rows of laced scales overlap in the opposite direction to others. Many of the scales in the rows that make up the armour overlap one another such that the right edge of one scale covers the left edge of the next scale to the right. The remainder overlap in the opposite direction (Fig. 49). In most sections of the armour the rows of scales do not appear to have been attached to the backing such that every other row of scales overlaps in the opposite direction. In one section of the armour, only one row in six or seven overlaps in the opposite direction. The sections of cross-laced scales and the smallest scales always appear to overlap in the same direction.

2.3.3.7) The Manufacture and Construction of the Armour

In the initial examination of the armour in November 1998, the lacing holes in the scales were thought to have been formed using a punch in which a small section of the scale would be removed thus facilitating the lacing. On re-examining the armour in February 2000, it was established that the holes in the scales are not punched, but rather they are small cuts through which the laces are threaded. This process would be difficult and time consuming if attempted on the hard, dry rawhide. As rawhide softens considerably when thoroughly wet, it would make this task considerably easier. It is possible that the scales were laced together whilst partly soaked and allowed to dry in a press of some fashion. In many of the lacing holes in the scales examined, the lace has pulled the edges of the cut with it, forcing the material out of its path. The length of the cuts varies which suggest that this process was done with a small knife blade pushed through the scale, the length of the cut depending on the depth to which the blade was pushed. Should the scales have been laced with a knife-pointed needle, the cuts should all be the same width. This suggests that cutting the holes and lacing the scales together were separate processes.

The small size of the scales and the high level of craftsmanship apparent in the armour are as one would expect from an item from TutʿAnkhamūn's tomb. With regard to this, time was probably not a consideration in the manufacture of this armour. As each scale has a uniform medial ridge pressed or embossed into it, the amount of time to manufacture the scales alone, much less lace them together, would be vast. Based on the size of the scales and an examination of the photograph, it is estimated that at least 2,000 scales, of various types and sizes, would be needed to assemble a "sleeveless" cuirass as Carter (1933: 143) described Tut'Ankhamūn's armour.

The red paint, or lacquer, which the scales were painted with was not analysed, so few hypotheses are possible. The paint was only applied to the faces of the scales and was most likely intended as decoration only. The climate in Egypt is such that one would not need to be overly concerned with the armour being damaged by moisture, and therefore, a sealant for the rawhide would not be necessary. As was discovered during the manufacture of the replica sections of armour for the experimental work (described in Chapter 3.1.3), modern rawhide of c. 1.5 to 2.0mm in thickness must be soaked in water for approximately 20 minutes before it begins to soften, and at least 2 hours before it becomes completely pliable. Should the armour have been soaked for only 20 to 30 minutes, little damage would likely occur as the lacing would hold the scales in place until dry.

The edges of each of the scales have a very slight curl toward the back of the scale which may be the result of the scales having been cut with a die. This may be the result of the cutting edge of a die, especially if the edges of the die were not perfectly sharp, thereby causing some crushing of the rawhide rather than only a cutting action. The hypothesis of the use of a die is, however, discarded through two points. First, the lack of absolute uniformity of the scales does not support the use of a die, and secondly, there are to the author's knowledge, no known examples of dies in the archaeological record of New Kingdom Egypt. The scales are even enough, however, that they were likely cut with a knife while using a template. It is not possible to determine if the scales were cut when the rawhide was wet or dry, however, it would have been easier to cut when wet, and it is almost certain that the medial ridges were pressed into the scales while the rawhide was wet.

At present, it is not possible to determine precisely how the medial ridges were formed. The uniform shape and size suggest that they were formed using a tool or press of some sort. It is possible that they were formed while the scales were held in a press to dry. As a section of rawhide is soaked, it will increase in volume and dimensions. As it dries, it tends to curl and distort, so in the production of flat pieces, numerous armour scales in this case, the rawhide must be pressed flat until dry. It is probable that the medial ridges are formed during this process.

The armour is too fragmentary and convoluted to establish precisely where each piece would fit into the completed armour. It is reasonable to assume that the sections of large scales would cover the majority of the front and back of the torso up to the neck, while the mid-sized and small scales would cover the shoulders and the area beneath the arm. The cross-laced mid-sized scales would be most useful beneath the arm where increased mobility is needed to enable the efficient use of a hand-held weapon. If Carter (1933:143) is correct in assuming that the cuirass was sleeveless, this may have enabled the wearer to more easily draw and shoot a bow.

The six folds of linen and the final thin leather under-coat would all add to the effectiveness of the armour. However, the size and thickness of the armour, and the very thin lacing, all would seem to decrease the amount of protection the armour would afford. The mid-sized cross-laced scales and the small scales, fixed only to a single layer of thin leather, would not provide as much protection as the larger linen-backed scales would. The scales attached only to a leather backing would probably have formed the shoulders and possibly the area under the arms, both areas which need an increased amount of flexibility. As the exposed laces would be more vulnerable to damage, this style of lacing would only be used in areas where it was necessary. As a counterpoint to this however, the rawhide that the scales are made of, if at all similar to modern rawhide, were very tough for their thickness, and it is this that makes this cuirass a good design for armour.

A coat of rawhide scale armour would not provide the same amount of protection that an identical one of bronze would if one does not account the factor of mobility. The increase in protection afforded by bronze scales would be offset by the greater weight which would result in decreased mobility. As armour is intended to aid in protecting the wearer rather than stop all blows completely, the increased mobility afforded by a lighter armour would be valuable. The choice of material used to make the armour would be governed by several factors including the desired weight and mobility of the finished armour, cost of materials and time of manufacture, the situations in which the armour would be used, and various social considerations such as conspicuous consumption.

2.3.3.8) Conclusions

The corslet of scale armour found in the tomb of TutʿAnkhamūn is, to the author's knowledge, the only surviving remains of Late Bronze Age scale armour which retain any evidence of the overall construction. The examination of this armour has allowed a body of knowledge to be compiled which can firmly establish the methods of construction and thereby challenge the existing hypotheses on scale armour construction. It is, however, certainly possible that there were other methods of lacing scales together to form a coat of armour. The fact remains that the patterns of lacing holes encountered is almost the same across the Eastern Mediterranean in this time period (see Chapter 4.6.2). The method of the lacing in TutʿAnkhamūn's armour is much simpler than that suggested by Kendall (1974: 272-273) and Ventzke (1986: 169-170) for scales from the other collections which have all but identical patterns of lacing holes. The craftsperson, or craftspeople, who manufactured TutʿAnkhamūn's armour appear to have chosen to employ the simplest methods, and it is certainly possible that other craftsmen across the Late Bronze Age Near East did likewise. The use of rawhide and linen would provide some degree of protection while not hindering the mobility of the wearer with a great weight of metal scales. Finally, the existence of a coat of rawhide armour confirms that organic armour existed, and was almost certainly more common than its metallic counterparts as the Late Bronze Age texts suggest.

The armour, if complete, would have contained some 2,500 or more scales made of a relatively inexpensive organic material. They were laced together into rows and affixed to a backing of linen such that the backing would provide some degree of padding, further protecting the wearer. Different sizes of scales and different lacing patterns were used where necessary, such as over the shoulders where a deeply curved area would require greater flexibility. The reason for the overall small size of the armour scales is not clear. It is possible that the smaller sizes were used simply as a means of conspicuous consumption, perhaps serving to increase the "status" of the armour through added workmanship rather than through the use of more costly materials.

It is possible that TutʿAnkhamūn's coat of armour was intended for concealed wear. It would have provided some hidden added protection for a very small decrease in mobility which may have been deemed acceptable. As Carter described the armour as a "close fitting sleeveless bodice" (Carter 1933: 143), the small scales may have been to provide better flexibility to hide the presence of the armour. Also, it may have been intended for use during the hunting of dangerous game, as a possible "last defence" if the hunter was attacked by his quarry. If true, the coat of armour would not be out of place amongst the other weaponry and hunting equipment present in the tomb.

2.4) Conclusions

This chapter has shown that the armour is generally associated with the elite sectors of society, and that the construction and form of the armour is somewhat more complicated than has generally been appreciated. The examination of Tutʿankhamūn's armour shows that the hypotheses presented by Ventzke (1986) concerning the structure and weights are acceptable, and also shows that armour was not exclusively made of metal. The lacing patterns suggested by Ventzke are not, however, correct. Furthermore, the Nuzi texts indicate that, in that region at least, there were coats of composite armour made of a combination of both bronze scales and leather scales.

The texts and the archaeological material together show that there were many different styles of armour scales, and that a variety of different types were required for the manufacture of a single coat of armour. The fact that there was some scope for stylistic variation from region to region can be seen in the slight differences in the appearance of the armour scales found in the various archaeological sites. The different forms of armour which are noted in the Nuzi texts also clearly suggests that there was either *A*) a degree of experimentation with different styles, or *B*) that different coats of armour were produced for different purposes. At any event, there must have been some experimentation to result in the variety of coats of armour noted by Kendall (1981: 201).

The various styles of armour presented in the Nuzi military texts could each have been made for a different purpose. Kendall (1981: 201) suggests that there are at least 15 styles of armour mentioned in the texts. These may have reflected the levels of social or military status of the soldier to whom it was issued, or the purpose for which the soldier would wear it.

Furthermore, the different styles may have been a reflection of both of these concepts. There are no known texts which specifically discuss these aspects, nor are there any depictions which would provide conclusive evidence. Ventzke's 1986 work has shown that similar armour scales, lacing in similar patterns, could be used to form coats of armour from a sleeveless corslet (akin to TutʿAnkhamūn's armour) to a half-sleeved hip-length coat, and perhaps up to a calf-length long-sleeved coat. Due to the complexity of the coats of armour, and the variety of possible styles, it is not possible to determine the style of armour from only a small number of armour scales. Even with the larger collections, such as from Kāmid el-Lōz or TutʿAnkhamūn's tomb, it is not readily apparent what the finished armour originally looked like. This is partly due to the absence of a complete, undamaged coat of armour, and the relative lack of detail in the ancient texts and depictions.

The Nuzi military texts, the Amarna Dowry lists, and the Battle of Megiddo Booty list all suggest that the armour was primarily, if not strictly, the province of the elite. Further confirmation, albeit from a biassed and not entirely chronologically sound set of texts, comes from the passages from the Old Testament. The ratio of 1 coat of metallic scale armour to 100 coats of leather armour as mentioned in the Battle of Megiddo is instructive, as this may show why there are relatively few metal armour scales found in Late Bronze Age contexts. Should there have been 100 times as many organic coats of armour as metallic, it is reasonable to suggest that although armoured troops may not have been quite common, metallic armour would have remained rare.

The fact that metallic armour scales appear in archaeological contexts all across the Late Bronze Age Near East shows that this military technology was not restricted to a single region. Although it is not possible to determine how many coats of armour were in use in a given region at a given point in time, it may certainly be reasonable to assume that there was more organic armour in use than metallic. Furthermore, the presence of a coat of rawhide armour in TutʿAnkhamūn's tomb shows that the wealthiest elite themselves did not always make use of the most expensive metallic armour. In this particular instance this may, as has been noted above, be due to its intended use for concealed wear, but it may also have been due to personal choice or the particular suitability for a given task.

Chapter Three

The Experimental Reconstruction and Testing of Sections of Late Bronze Age Scale Body Armour

Introduction

Prior to conducting an assessment of the socio-economic factors governing the use of body armour it was judged necessary to establish the degree of protection actually afforded by the scale body armour as used in the Late Bronze Age Near East. To examine the effectiveness of the armour a series of experiments were devised in which sections of Late Bronze Age-style scale armour were replicated in a variety of materials and tested against replica Late Bronze Age Near Eastern archery equipment. Four sections of replica scale armour were manufactured from alum-tawed leather, rawhide, and bronze. One section of scale armour each was made from alum-tawed leather, rawhide, and bronze, while a fourth section was made from a composite of both rawhide and bronze. Rawhide and bronze were both used for the manufacture of scale armour in the Late Bronze Age as evidenced by the rawhide scale cuirass found in the tomb of Tutʿankhamūn, and the variety of bronze armour scales found in Late Bronze Age archaeological sites throughout the Near East. As the initial identification of the material from which Tutʿankhamūn's armour was made, a section of replica scale armour was manufactured from Alum-tawed leather for the first stage of testing in 1999. Although made of an inappropriate material, it was decided that testing this section of replica armour would also provide an interesting comparison with the rawhide and bronze sections of armour, and as such it was included in the tests.

Given the tripartite association of scale body armour, chariots, and archery with the elite sectors of the Late Bronze Age military bodies, it was decided that the armour should be tested against replica Egyptian New Kingdom archery tackle. Archery tackle, a relatively straightforward set of equipment to use, was chosen so as to reduce the number of variables in the experiment. Given that the bow and the arrows used in the experiments were reproduced as authentically as possible, the actual shooting of the bow was less open to variables of individual technique. It was decided to forgo testing the armour against swords or spears due to time constraints, expense, and the lack of information on the specific techniques of use of these weapons in the Late Bronze Age.

The premise upon which the series of experiments were based is as follows:

> If the armour is judged as being *effective* in protecting the wearer, the armour was a potentially useful item of military equipment which was "secondarily" associated with high status. However, if the armour is deemed *ineffective* at protecting the wearer, it must primarily represent a system of increase in status of elite military personnel through stylistic or fashion consideration or by its link to conspicuous consumption.

To avoid entering too many variables into the experiments, every effort was made to manufacture the armour and archery tackle from authentic materials. To save time, modern materials were substituted when it proved impossible to obtain suitable authentic materials, and this has been noted below in all instances. The very slight differences in performance of the armour and archery tackle that may have resulted from the use of modern materials have been deemed as below measurable significance.

3.1) Production of the Replica Sections of Scale Armour

3.1.1) Production of the Alum-Tawed Leather Scale Armour

For the experimental testing of the armour at H.M. Royal Armouries Museum (Leeds), a section of replica alum-tawed leather scale armour was made, based upon the leather scale cuirass found in the tomb of Tutʿankhamūn (artefact #587a). The examination of the armour, discussed above (see Chapter 2.3.3), showed that the majority of the armour was composed of scales made from animal hide, each measuring approximately 2.0 to 2.5mm in thickness. The material was initially mis-identified as alum tawed leather by the colour of the inner (suede) side of the scales, which ranged from almost true white to a very pale yellow colour. Tawed leather is usually totally white when the tawing process is complete (Sharphouse 1983: 151), the pale yellow colour was, in the opinion of the author, an acceptable degree of colour change over the 3000+ years that armour lay in Tutʿankhamūn's tomb.

Contact with the British Leather Commission and several tanneries and leather suppliers lead to the purchase of a section of "B-grain firm, Bandsman Shoulder" alum tawed leather from Joseph Clayton and Sons (Chesterfield), Ltd. The leather was from cattle hide rather than sheep or goat hide which is more likely what Tut'Ankhamūn's armour was made from. No scientific analysis of the materials in Tut'Ankhamūn's armour was possible, so this remains a supposition. When the leather arrived, it measured approximately 4.0 to 5.0mm in thickness which initially proved problematic, as the scales needed to be no more than 2.5mm in thickness (which, perhaps, would be the thickness of alum tawed leather made form sheep or goat hide). The large scales in Tut'Ankhamūn's leather scale cuirass measured, on average, 50mm in length, 20mm in width, and 2.0 to 2.5mm in thickness.

3.1.1.1) Forming the armour scales

The process of forming the leather scales to be used in the construction of the replica section of armour first involved marking out strips 20mm wide and approximately 600mm in length. These strips were marked and then cut from the hide with a sharp craft knife and a metal straight-edge ruler (Fig. 50a). Several strips were cut at one time. A flat-base *Stanley* brand spokeshave (model No. 151) was used to thin the leather to the appropriate thickness of approximately 2.0mm. Each strip of leather was clamped suede side up to one end of a board which was angled from the edge of the work table to the seat of a chair, the strip of leather laying against the surface of the board (Fig. 50b). To hold the board in place, the author would sit upon the chair, holding the end of the board between the knees. The spokeshave, set to remove approximately 0.5mm of leather at a stroke, was drawn evenly down the length of the strip. This process was repeated, with the thickness being measured at several points along the length of the strip between each stroke, until the correct thickness was achieved. The leather strip was then removed and reversed, the end formerly clamped to the board then worked down to the same thickness as the rest of the strip. The process of thinning the strip to the appropriate thickness tended to stretch the strip from the original c. 600mm to approximately 640mm to 660mm. At this stage of the experimental work it was still assumed that the leather used in Tut'Ankhamūn's armour was alum tawed hide, and it was therefore not known which method was used to control the thickness of the leather used in the original armour. It is possible that no method was necessary if the leather was the thickness of the original animal's hide, therefore the method applied in the manufacture of the tawed leather scales was chosen as it was expedient and was not thought likely to compromise the strength of the finished armour.

Having thinned several strips to appropriate thickness, the scales were then marked out. This was done by using a metal ruler and marking out rectangular sections 50mm long down the entire length of the strip, 12 scales generally being marked per strip with approximately 20mm excess left at the end. After the rectangular sections were marked out, the pointed ends of the scales were marked "by eye", with an approximately 90° angle to the point (Fig. 51a). To cut out the individual scales, each line marking the top edge of a scale, and therefore marking the lower edge of the next scale, was placed level with the upper surface of the jaws of a small bench vise (Fig. 51a) which served as a guide for the craft knife. This process was repeated for all the scales marked out on the strips, after which the points were formed by cutting (with heavy shears) two triangular pieces of leather, previously marked, from the end of each rectangular piece (Fig. 51b). After several dozen scale blanks were cut out, the lacing holes were punched.

To form the lacing holes in the scales a small leather punch of approximately 3.0mm in diameter was reshaped. An oxygen-acetylene torch was used to heat the tip of the punch to a bright red heat after which it was reshaped with a pair of small, pointed pliers into a flat-sided oblong shape (2.0mm by 4.5mm). The punch was then re-heated to a dark red heat and slack-quenched in oil to attain the proper temper. After sharpening the punch, it was ready for use. The holes were punched by laying the scales suede side down against a wooden plank and striking in the holes with the punch and hammer. Five holes were struck into the scales in lacing hole pattern #3 (see Fig. 72), the pattern most common in the scales from TutʿAnkhamūn's cuirass. This process was completed until all the scale blanks were finished, at which point the whole process was repeated to produce another batch of scales. Once all the scales were finished (250 in number), the edges of each scale were trimmed with hand shears to remove excess fragments of leather.

3.1.1.2) Lacing the scales together

For lacing the scales together into strips, leather laces were made from the same alum tawed leather as the scales. The 20mm wide strips were prepared in the same process as for the scales, but were reduced to approximately 1.5mm in thickness, approximately the same thickness of lacing as in Tutʿankhamūn's armour. Five or six laces, measuring from 3.3mm to 4.0mm in width, were then cut from the strip using hand shears (Fig. 52) to a total length of approximately 600mm, which allowed extra material for loosely lacing the scales into rows before adjusting them to their proper spacing, and for tying the knots.

The scales were laced together, side by side, into 10 rows each of 25 scales using the laces described above. The laces were kept with the epidermal side facing upwards, the same as the outward surface of the scales. A single knot was tied into one end of both laces and the first scale was laced. Beginning with the scales held with the outer (epidermal) side facing upward and the pointed end of the scale towards the author, the first scale was laced by running the lace through the right hole of the upper pair of holes from the front of the scale through to the back, and then through the left hole from the back through to the front. The lace was then run through the right hole of the lower pair from the back of the scale through to the front, and then through the left hole from front to back. This process was then repeated for the remaining 24 scales, placing each scale so that it was up against, and overlapped by, the scale directly to the right (Fig. 53). When all 25 scales were laced together, the laces were tied in knots to prevent the row of scales from coming apart. This process was repeated until 10 rows of scales were completed.

3.1.1.3) The Linen Backing

Based on the analysis of Tutʿankhamūn's armour, and corroborated by the description given by Howard Carter in his excavation notes (see Chapter 2.3.3.2 and 2.3.3.4), the rows of alum-tawed leather scales were then fixed to a backing of several layers of linen. The backing material on Tutʿankhamūn's armour was made of six layers of a 64 threads-per-inch weave linen cloth. It must be noted that the linen used in Tutʿankhamūn's armour may have been of considerably higher quality than that used by the majority of soldiers. The linen used for the experiment was of a somewhat more coarse weave (28 threads-per-inch) and slightly heavier weight than that used in Tutʿankhamūn's armour, but as this linen was all that was available, it was chosen. In an attempt to keep as close to the original armour as possible, natural un-dyed and un-bleached linen was purchased.

A length of linen was selected and was cut into six pieces, each 30cm by 30 cm (12 inches square). The six layers were then stacked upon one another and the edges sewn together by hand with a heavy cotton thread to prevent the weave from coming apart. The rows of laced scales were then fixed to the linen backing by twice running a double length of heavy cotton thread through the linen backing, through the uppermost hole on every other scale in the row, over the top edge of the scale, and back through the linen. This resulted in 13 individual stitches for each row of scales on the section of armour. Ten rows of 25 scales each were thus fixed to the linen backing. Four loops of nylon lacing were then stitched to the linen backing, one to each corner, to be used in tying the armour to the target. For the weights of the replica sections of scale armour, see Table 2.

3.1.2) Production of the Bronze Scale Armour

3.1.2.1) The Type of Armour Scales Replicated

For the replica section of bronze scale armour, a combination of two scale types was derived from those found at Kāmid el-Lōz in Lebanon (see: Chapter 2.3.1 and Ventzke 1986). It was decided that Type IIb and Type III armour scales from Kāmid el-Lōz should form the basis for the replicated scales as they form the largest group of homogenous metallic scales in the Late Bronze Age Near East for which measurements and appearance are known. The combination of Kāmid el-Lōz scale types IIB and III was done to enable a greatly increased rate of production, whilst still replicating the pattern of the most common type of scale at the site. Type IIB and Type III scales are the same size and have the same lacing pattern save for a difference in the single uppermost hole. The uppermost lacing hole on Type IIB scales is positioned to the right of the medial ridge slightly above and opposite the upper pair of lacing holes. The uppermost lacing hole on Type III scales is to the left of the medial ridge and directly above the pair of upper lacing holes (Fig. 54a). The holes in Type III scales are round whereas the lacing holes in Type IIB are rectangular. Type IIB scales are the most common scales found at the site, but the rectangular holes would have presented considerable difficulty in the production of the scales. Therefore, the exact lacing pattern of Type IIB was used with the round holes of Type III.

3.1.2.2) The Bronze Material

The bronze for the replica armour was graciously provided by E.I.P. Metals, Ltd. of Birmingham (greatest thanks to Martin Vindy, technical director and Paul Randall, metallurgist). The bronze is the modern British Standard phosphor-bronze alloy PB-102 and comprises 4.5 to 5.0% tin, c. 0.5% lead, c. 0.4% zinc, c. 0.5% other impurities, and between and 0.0% and 0.04% phosphorous, the remaining constituent being copper. The bronze, as delivered, was in a 25% work-hardened state. This alloy is the most similar, readily available, bronze to the average ancient bronze, the inclusion of the phosphorous not withstanding. In personal communication with Paul Randall it was determined that the presence of such a small amount of phosphorous in the bronze would not adversely affect the properties of the bronze as used in the replica section of armour. The majority of Late Bronze Age bronze weaponry from Israel/Palestine studied by Khalil (1980) had a tin content ranging from 4% to 12% (Khalil 1980: 76-77), and as such, the modern PB-102 alloy used was deemed appropriate.

Pure or near pure copper alloy is difficult to cast due to gas bubbles in the metal and the tendency of the metal to shrink, thus producing poor quality casts which are porous. However, some cast pure copper artefacts do exist, right up to the New Kingdom. Arsenic, more common in earlier copper alloys, occurs in trace amounts in most Egyptian copper alloy artefacts, but declines in use by the New Kingdom (Ogden 2000: 152). A noticeable increase in hardness, and a decrease in toxicity, is achieved with the addition of tin. Furthermore, the melting temperature drops from 1083°C to 1005°C in an alloy of 10% tin. This decrease in melting temperature facilitates easier casting, as does the tin itself which increases the fluidity of molten bronze (Ogden 2000: 153). Arsenic and tin both act as de-oxidants which facilitate better castings while also increasing the hardness of the final product (G. Philip, pers. comm.).

Within the tomb of TutʿAnkhamūn, there were more objects of copper than of bronze (Lucas 1962: 220), however most metallic objects were actual tin-bronze by the Ramesside period. The majority of the bronze artefacts in Egypt were up to 10% tin, which was typical in antiquity, although there are examples alloyed with up to 16% tin, but this is uncommon (Ogden 2000: 154). Not much work has been done on the correlations between function and composition, but it is to be expected that there should be distinctions between i.e. weapons and decorative objects due to the working properties of the alloys, for instance some alloys provide better casting properties while some are better for cold working. It is also likely that a wide range of symbolic distinctions also governed the use of particular alloys (Ogden 2000: 154).

The bronze used in the manufacture of the armour scales arrived in three large coils of strips 1.0mm in thickness and pre-cut to a width of 23.0mm (Fig. 54b), which was the average width and approximate thickness of Kāmid el-Lōz Type IIB and Type III scales replicated for the experiments. The bronze was precut by the foundry into a suitable width to save time in manufacturing the finished scales.

3.1.2.3) The Scale Template

Before beginning to shape the scales, a single scale was formed by hand without machinery to serve as a template. A section of the bronze was cut to 65.0mm in length and drilled to exactly match the placement of the lacing holes in Kāmid el-Lōz Type IIB scales. With use of this prototype scale, Jim Hodgson (University of Durham Chemistry Department workshops) formed a jig in which to drill 6 scales at a time and also formed a set of dies with which to press the medial ridge into the scale (Fig. 59a). With these aids, the rate of production of the scales was greatly increased.

3.1.2.4) Cutting the Bronze Scale Blanks

The *first stage* in making the replica scales was to use a pair of hand shears to cut several sections of bronze from the spool each of which were 1.30m long. These strips were then taken to the electric metal guillotine to be cut to the correct lengths. The stops on the guillotine were set to cut pieces 13.0 centimetres long from the 1.30 metre long strips, each piece being exactly the length of two finished scales. After all the strips had been cut into these 13.0cm pieces, an angled stop was set on the front table of the guillotine to a 45° angle and the back-stop set at 8.0mm. Each of the 13.0cm pieces of bronze had the corners cut from it resulting in an angle at both ends (Fig. 55) still with a total length of 13.0cm.

3.1.2.5) Drilling the Lacing Holes

A 2.3mm drill bit was used to drill the lacing holes, as this provided a hole large enough to enable lacing the scales together, but allowed enough bronze to remain to avoid weakening the scales between the lacing holes and between the pairs of lacing holes and the edge of the scale. Drilling the holes into the scales involved placing a stack of six of the double scale blanks into the jig and tightening the screws to hold them in place. The 2.3mm drill bit was inserted into the chuck of the drill press and set to the correct depth to drill through the six blanks, but avoid drilling into the base of the jig. A small amount of cutting coolant (a thin oil-based liquid used to cool mechanical cutting tools during use) was applied to the surface of the six double scale blanks, and the seven lacing holes were drilled. The scale blanks were then removed, turned around, and re-inserted into the jig to drill the remaining seven holes. This process was continued for all the double scale blanks, after which they were taken back to the guillotine and cut in half. The back-stops of the guillotine were set to 65.0mm and each of the double scales were cut exactly in half. This resulted in scales 23.0mm in width and 65.0mm in length, each with the necessary seven holes drilled into them.

3.1.2.6) Pressing the Medial Ridges

After all the scales were cut to the proper length, they were taken to the fly-press to have the medial ridges pressed into them. The two halves of the medial ridge press die (Fig. 56a) were fitted into the press and aligned to each other. Each scale was placed face down in the alignment groove in the lower half of the die to make sure that the ridge would be pressed in from the back (Fig. 56b) (a medial ridge pressed in from the front would result in a scale with the opposite lacing pattern to that desired). The arms of the press were then spun down, pressing the required ridge into the scale (Fig. 56c). This process was repeated, until all the scales were finished.

3.1.2.7) Lacing the scales together

The scales were laced together exactly as was done for the replicated section of tawed leather scale discussed above armour except for two differences. Three laces were used instead of two, as there were three pairs of lacing holes in the bronze scales, the extra lace being used to lace through the second pair of holes to the right of the medial ridge and slightly below the middle of the length of the scale. The second difference was that the laces used for lacing the bronze scales together were made from common strong 1.5mm cotton twine, as round lacing was deemed better suited to round lacing holes, as opposed to the flat lacing used in lacing the sections of alum-tawed leather scales which all have "rectangular" (oblong) lacing holes (Fig. 57a).

It is assumed here that the rectangular lacing holes of several of the types of scales found at from Kāmid el-Lōz were for flat leather lacing, but there is no firm evidence to confirm this assumption. The leather scales in TutʿAnkhamūn's cuirass were all laced with flat leather laces, which is the root of the above assumption, although the holes in the scales appear to have been cut with a knife as a simple slit rather than punched with a rectangular- or oblong-faced punch (see Chapter 2.3.3.7). It is not known what material the scales with round holes from Kāmid el-Lōz were laced with, hence a common cotton fibre twine was used.

The backing for the replicated section of bronze scale armour was made in exactly the same manner as for the replicated section of alum-tawed leather scale armour (as described above), differing only in the dimensions. As discussed above, six layers of natural linen (from the same bolt of cloth purchased for the armour described above) were cut and stitched together (Fig. 57b). The resulting linen backing measures 37.0cm (14.6 inches) in length and 34.5cm (13.8 inches) in width. This increase in size is due to the relative size of each of the bronze scales being greater in width and length than the scales produced for the replicated section of alum-tawed leather scale armour.

As with the replicated section of leather scale armour, the rows of bronze scales were fixed to the linen backing in the same manner, with a doubled length of thread looped through the linen (from the back), run through the uppermost lacing hole of every other scale in the row (13 stitches per row of 25 scales), over the top of the scale, and back through the linen, and then repeated again, before being tied at the back with a simple square knot. After the rows of scales were attached, eight loops of nylon lacing were attached to the linen backing (one at each corner, and one half way along each side) to provide points from which to tie the armour to the target during the experiments. The total weight of 250 bronze armour scales, minus the linen backing and lacing, is 2.92 kg (Fig. 60a) (see Table 2).

3.1.3) Production of the Rawhide and Bronze/Rawhide Composite Scale Armour

3.1.3.1) Cutting the Rawhide Scales

The rawhide armour scales were produced in an almost identical manner as the bronze scales. After consulting several tanneries in Britain, a half hide of drumskin-grade rawhide was purchased from Joseph Clayton and Sons (Chesterfield), Ltd. as this was the only form of commercially available rawhide. The rawhide was spread out and a length of the bronze used in the production of the bronze armour scales was used as a template to mark out 23.0mm wide strips which were then cut from the hide with a pair of hand shears (Fig. 58). The strips of rawhide were then marked off into 13.0cm sections and cut with the shears to form the same type of "double scale blanks" as in the production of the bronze armour scales. Both ends of each 13.0cm section were cut into a point with the shears at approximately a 45° angle.

3.1.3.2) Drilling the Rawhide Scales

The same drilling jig that was used to drill the lacing holes into the bronze scales was used in drilling the lacing holes into the rawhide scales. It was decided that drilling the lacing holes into the rawhide scales would be considerably quicker than using an equivalent leather-workers punch, as holes could be drilled into several scales at a time. To drill the holes, a stack of seven or eight rawhide scale blanks was placed into the jig with a single bronze scale blank (retained from the manufacture of the bronze scales) placed on top of the stack (Fig. 59a). This allowed the rawhide scale blanks to be pressed flat within the drilling jig, ensuring that the holes were drilled in the identical position for each scale. After the rawhide "double scale blanks" had been drilled, each was halved in length prior to pressing the medial ridges.

3.1.3.3) Pressing the Medial Ridges into the Rawhide Scales

The medial ridges were pressed into the rawhide scales in the same manner as for the bronze scales. As the rawhide scales were more malleable than the bronze scales, pressing one scale at a time was relatively unsuccessful, so a pair of scales were placed onto the lower half of the medial ridge press-dies (Fig. 56a) and the ridge was then formed. As the rawhide is a softer material, the medial ridges did not strengthen the scales much, but did help to keep them flat, as the section of rawhide purchased from Joseph Clayton and Sons (Chesterfield), Ltd. had been rolled into a cylinder upon delivery. The curl of the rawhide did not prove problematic during production of the scales, but certainly would have caused difficulties upon lacing the scales together to provide a flat section of armour had the medial ridges not been pressed into each scale.

3.1.3.4) Lacing the Rawhide and Bronze Armour Scales Together to form the Sections of Armour

Upon completion of a quantity of rawhide armour scales the process of lacing the scales together to form the two remaining sections of armour was begun. Two sections of armour were produced, each in the same form as the section of bronze scale armour described above: one section was formed entirely from 250 rawhide scales, weighing 0.49kg (minus the linen backing and lacing) laced together and stitched to a linen backing (Fig. 60b), the other a composite of 125 rawhide scales and 125 bronze scales (Fig. 60c) weighing 1.70kg (minus the linen backing and lacing) (see Table 2).

The methods of lacing the scales for these two sections of armour were identical to those used to lace the bronze scales together: ten rows of twenty-five scales each were laced together. The differences being that for one section only rawhide scales were laced into rows (Fig. 61), while in the second section of armour, rawhide and bronze scales were alternately laced into rows. For the composite rawhide/bronze section of armour, five rows of scales were laced together with thirteen of the twenty-five scales being bronze, and five rows where 13 of the rawhide scales were alternated with 12 bronze scales. Two sections of linen backing were then produced in an identical manner to that described above for the section of bronze scale armour.

3.1.3.5) Stitching the Rows of Scales to the Linen Backing

For the composite armour the rows of alternating rawhide and bronze scales were stitched to the linen backing such that a row of scales with 13 bronze scales would be followed by a row with 13 rawhide scales. The finished appearance would be such that at no point would rawhide overlap rawhide, nor would bronze overlap bronze (Fig. 62). This was done to provide a section of armour with no "weak" spots which were only covered with rawhide. After stitching the rows of scales to the two sections of linen backing eight cord loops were attached to each section of armour (as with the section of bronze armour described above).

3.1.3.6) Manufacturing Time

It has been estimated by the author that a waist-length short-sleeved coat of armour of approximately mens size 48 (1.88m height at 100kg weight) would need approximately 1,600 amour scales. This broadly agrees with Ventzke's (1986: 63) suggestion of 1.67m height for an individual of European size 48 to 50 which he bases on the Iron Age skeletons from the Persian cemetery at Kāmid el-Lōz. This would equate to quite a robust individual, although that may be expected of a trained warrior. The following breakdown of time to manufacture a coat of armour has been based on the time taken for the manufacture of each armour scale. This method, while not strictly accurate, is a fair approximation of the total time needed in manufacture. The manufacturing time noted here is based on the armour manufactured by the author, and it must be noted that modern machinery was used in as many stages as possible. A Late Bronze Age craftsperson would not have had access to this machinery, resulting in hand finishing of the armour scales one-by-one. A skilled craftsperson may well have been able to produce armour scales by hand considerably more quickly than the present author could, although probably not as fast as through using modern machinery. It is not clear what method was used in the Late Bronze Age to form the bronze sheeting from which the armour scales were cut, so this too is a matter which may have greatly increased the manufacturing time. The manufacturing time noted below for the rawhide armour is perhaps more accurate, as this involved fewer modern tools. The manufacturing time presented below does, however, allow a measurable indicator to be established.

Bronze scale armour

- cut 1.30m lengths from spool = 20 scales = 20 seconds per strip	= 1 sec per scale
- cut 1.30m lengths to double scale blanks = 40 sec	= 2 sec
- cut 4 points into double scale blank = 15 sec.	= 7.5 sec
- drilling six double scale blanks at a time = 420 sec for 12 scales	= 35 sec
- cut two double blanks into 4 scales = 10 sec	= 2.5 sec
- pressing the medial ridges	= 10 sec
TOTAL per scale	53 seconds
53 seconds each scale, multiplied by 1,600 scales	= 84,800 seconds
	= 1,413 minutes
	= 23.6 hours

Rawhide scale armour

- Mark out strips for armour scales (approx. 10 scales)	= 3 sec per scale
- Cut strips from hide = 1 minutes per strip	= 10 sec
- cut double length rectangles from strips	= 1 sec
- cut points into double length rectangles = 4 seconds	= 2 sec
- drill holes in 8 double blanks = 240 seconds for 16	= 15 sec
- cut one double blanks into 2 scales	= 1 sec
- pressing medial ridges into 2 scales at a time = 12 sec.	= 6 sec
TOTAL per scale	38 seconds
38 seconds each scale multiplied by 1,600 scales	= 60,800 seconds
lacing hole pattern 5 or 6	= 1013 minutes
	= 16.9 hours

Manufacture of the backing material / tunic - estimated at approximately **= 6 hours**
Based on prior work conducted by the author, but not associated with this thesis.

Lacing the scales into rows

Preparing the laces (3 laces per row)	= 60 sec per row
Lacing the scales together - 25 scales in a row (30 sec per scale)	= 750 sec
Preparing the thread and needle (twice per row)	= 45 sec
Stitching the rows to the backing (13 stitches [45 sec each])	= 585 sec
TOTAL time per row of 25 scales	1,440 seconds
1,600 scales divided by 25 scales per row = 64 rows	= 92,160 seconds
	= 1,536 minutes
	= 25.6 hours

The manufacture of a coat of armour is the combination of the time necessary to make the armour scales, stitch the backing material or tunic, and lacing the rows of scales together and stitching them to the backing. For the coat of bronze armour a total of at least 55.2 hours would be necessary, while a coat of rawhide armour, with a slightly lower time of manufacture of the armour scales, would take at least 48.5 hours. A composite coat of armour would require approximately 51.9 hours of work. Again, it must be noted that this is only a rough approximation of the time necessary to manufacture a coat of scale armour with modern machinery. The Late Bronze Age craftspeople would have needed more time, but as they were skilled, professional metalsmiths and leatherworkers who, if they produced large quantities of scale armour, may have been able to decrease the total manufacturing time substantially, but it would still represent at least one full week of work. Even with skill and practice, the total manufacturing time would still have likely been greater than that when using modern machinery.

3.2) The Testing of the Armour at H.M. Royal Armouries Museum, Leeds.

The testing of the effectiveness of the replicated sections of leather, rawhide and bronze armours was conducted on 06/09/1999 and 08/12/2000, at the Royal Armouries Museum, Leeds. The experiments involved using a modern replica of a Late Bronze Age angular composite bow (see Rausing 1960: 76, McLeod 1982) [Fig. 63] to shoot replica New Kingdom Egyptian arrows at the replica sections of armour (see Appendices 4 and 5).

The replica Late Bronze Age Middle Eastern bow was made by master bowyer Edward McEwen in 1999, and was graciously provided by the Royal Armouries along with a selection of New Kingdom arrows also made by McEwen (for details on the construction of the bow see Appendix 4). The arrows made by McEwen were made from narrow shafts of Japanese bamboo and are of similar construction to the arrows made by the author (see Appendix 5), but were fitted with different points. Three of the six arrows provided were fitted with relatively blunt, broad cold-hammered bronze points (Fig. 64a) while the other three were fitted with long tapered ebony bodkin points in place of the footing and bronze point (Fig. 64b). These arrows were based on the variety of ebony bodkin-pointed arrows found in TutʿAnkhamūn's tomb (see McLeod 1982: 19). No specific information is available on the methods of construction employed by McEwen in the construction of these arrows, however they have been made with materials suitable for these experiments. A selection of ten arrows were by the author and based the group of 30 arrows found in the tomb of TutʿAnkhamūn (Carter's tomb #370RR). The specifics on the manufacture of the arrows used in the experiments may be found in Appendix 5.

3.2.1) The Method of Drawing the Bow

In the experiments, the bow was drawn with both a standard modern European draw (drawn to the chin) and a replicated "Egyptian/Mediterranean" draw (drawn past the ear). The two different draw lengths were employed to ascertain the difference a greater draw length might produce in the experiments. The length of draw for any given bow will affect the speed that it will cast an arrow. Given that the bow is not drawn to the point where it breaks, the greater the length of draw, the greater the effort necessary to hold the bow drawn to that length. This effect, correctly termed "stacking", applies to all types of bows except the modern compound bows (which are well beyond the scope of this thesis). For a right-handed archer the most common modern method of using a bow in the western world is to place the nock of the arrow onto the string at a predetermined point with the shaft of the arrow resting on the left side of the handle of the bow. The archer the grasps the handle of the bow in the left hand, and hooks the string behind the last joint of the index, middle, and ring fingers of the right hand with the nock of the arrow (on the string) between the index and middle fingers. The left arm is raised and held out and the right hand then draws the string to the either the corner of the mouth or beneath the chin. For the author the draw length in this style, with McEwen's replica bow, was 745mm (29.33 inches).

In attempt to maintain historical accuracy, the replica angular composite bow used for the experiment was used in the manner depicted in the reliefs of New Kingdom Egypt. This style of drawing and shooting a bow is here termed the "Mediterranean draw". It is often difficult to determine the fine points of this style from the tomb and temple reliefs, but it is in most aspects quite similar to the modern standard method used in the western world. The Mediterranean draw most often appears to involve using only the middle and ring fingers of the right hand to drawn the bow, and the string is drawn past the ear rather than to the corner of the mouth. Aside from these points, the aspects of this style appear to be much the same as for the modern standard Western method (see Stone 1999: 135). For the author, and for Andrew Bodley (the other archer who participated in the experiments, as noted below), the Mediterranean draw is 845mm (33.25 inches), which was about the limit to which McEwen's replica bow could be drawn.

When an archer uses the Mediterranean draw rather than the standard modern draw, the limbs of the bow will be bent further due to the increased length of draw, and will therefore have stored more potential kinetic energy. When the string is released the bent limbs of the bow will straighten, pulling the string from the angle at which it was held back into line with the tips of the bow limbs. This action pushes the arrow along, and the greater the length of draw, the greater the amount of time the arrow will be pushed by the string. Given that the same bow is used, a greater draw length results in both an increase in the stored kinetic energy and an increase in the amount of time the arrow is being pushed. The result is that the arrow will leave the bow at a higher velocity. If arrows of the same construction and same weight are shot from the same bow but at different draw lengths, the arrow shot with the longer draw length will have a higher velocity, and consequently more momentum, as mass multiplied by velocity equals momentum. The potential energy possessed by the arrow (in flight) prior to impact with the target is calculated as $E=(0.5*m*(v^2))$ [where m is mass and v is velocity]. The amount of damage that is done to the target is directly related to the amount of energy that is transferred upon impact and the rate at which it is transferred (Blyth 1980: 3). If the same arrows are used, but launched at different speeds, the faster the arrow, the greater damage. It is for this reason that angular composite bows were drawn to the ear rather than to the corner of the mouth. A text and depiction in Theban Tomb #109 shows the Egyptian god Min teaching Amenophis II how to shoot, and also states that he should "draw the bow to the ear" (McLeod 1966: 13-19). This process, as described above, allows the bow to be drawn to a greater weight, and this imparts more force to the arrow upon release.

3.2.2) The Target

The target used for this experiment was a martial arts punching bag of approximately 50cm diameter and 100cm in length, weighing approximately 15 to 20kg. The target was suspended with nylon strapping from the ceiling rafters of the studio and tied to a weight on the floor. The weight on the floor was to prevent the target from swinging freely, thereby lessening the effectiveness of the impact of the arrows. By nature the human body is able to move and compress when struck with a given force and it is due to this that John Waller (of H.M. Royal Armouries Museum) suggested that this target be used rather than a wooden board. Upon striking armour mounted on a solid, static target of wood (or another hard material), all the kinetic energy of the arrow in flight is transferred to the target (and therefore to the armour) which would give a false impression of the effectiveness of the armour (John Waller, pers. comm. 1999). To best simulate a human body, the ideal target to attach the armour to would have been a whole pig carcass (John Waller, pers. comm. 2000), but this proved to be impractical for the short duration of the experiments due to high cost and other logistical problems.

In all periods of history some form of clothing was worn beneath body armour to protect the wearer from being abraded and irritated by the armour and to provide a cushioning layer to decrease the damage suffered to the body as a result of a weapons strike. Although it is uncertain what would have been used for this in the Late Bronze and Early Iron Ages in the Eastern

Mediterranean, it was decided that the target should be covered with some form of clothing. In the first session of the experiments at H.M. Royal Armouries Museum a light wool arming jacket (seen beneath the bronze armour in Fig. 67), as worn in the medieval period in Europe, was fitted over the target. Although this arming jacket is far later than the time period of the armour tested, it is not thought that it adversely affected the results of the experiment due to its simple construction. The jacket was of simple cut and design and made of several layers of thin wool. It buttons up at the front and is of a total thickness of not more than 7.0mm to 8.0mm (c. 1/4 inch). The thickness of the garment worn beneath armour varied considerably depending on the type of armour worn over it. The thickness of the arming jacket used in the experiment was judged to be of an acceptable thickness as an examination of the reliefs of the ancient world, and the generally high day-time temperatures, suggest that a relatively thin garment was used in the ancient Middle East. The particular style of the garment worn under armour would determine to a degree how easily one could move while wearing the armour, but as this experiment involved a static target, the particular style of undergarment was deemed unimportant. In the second session of the experiments at the museum, a thin linen shirt was placed around the target instead of the woolen arming jacket (seen beneath the rawhide armour in Fig. 69). Due to the 14 months between the experimental sessions, it proved impossible to locate the same arming jacket as had been used initially.

The experiment was set up to test the effectiveness of the armour at a distance of seven metres from the archer. This is the standard distance at which the Royal Armouries conduct their tests, and this distance was also suitable for the filming studio in which the tests were conducted. Seven metres would have been approximately the closest distance that any archer would be to the intended targets in a battle situation. Due to the decreasing energy of an arrow in flight (due to gravity and air resistance/drag), the greatest transference of energy from arrow to armour would occur at this short range. To best test the maximum effectiveness of the armour, this short distance was chosen.

3.3) The First Session of Experiments at H.M. Royal Armouries Museum - 06/09/1999

3.3.1) The Sea Peoples' Leather Armour (see Appendix 1)

Once the target was set up and the arming jacket fitted, the first piece of armour to be tested was the replica Sea Peoples' armour made of waxed vegetable-tanned leather. This armour was fitted over the arming jacket and target in the same manner as it would have been worn. The sleeves of the arming jacket were gathered up and tied behind the armour to keep them out of the way.

The Sea Peoples' armour was manufactured by the author in 1997 as a result of research conducted for a Master of Arts degree at Katholieke Universiteit Leuven (Belgium, 1995-1996), and was intended to examine the movement and construction of this type of armour. The Sea Peoples' armour was not originally intended to be tested in this manner, and as such, the waxed leather was inappropriate for this series of experiments. Nonetheless, as the author had the armour available at the time of the first series of tests at H.M. Royal Armouries Museum, it was tested. The armour should more properly have been made from rawhide rather than the waxed vegetable re-tanned (partially chromium tanned, and partially vegetable tanned) leather that was used.

Three shots at the replica Sea Peoples' armour (Fig. 65) were made using the replica Late Bronze Age composite bow with three types of arrows (Table 3a, shots 1-3). The first arrow used was an ebony-pointed arrow which penetrated two of the layers of the leather armour to a total depth of 44mm. The second arrow shot was one of the bronze pointed arrows made by the author which penetrated a single thickness of the armour and the target to a depth of 120mm. The third shot used an arrow made by McEwen fitted with a relatively blunt bronze point, and again penetrated a single thickness of the armour and the target to a depth of 69mm. All three arrows remained undamaged as a result of these shots. This corslet of replica armour did not prove to be very effective in protecting the target beneath, and this may be in part due to both the design of the armour and the use of waxed leather. It should not here be taken that this armour is not effective, as there are too many inconsistencies associated with the production of this replica. Further experiments of a similar nature, using a replica corslet of Sea Peoples' armour made from rawhide may provide very different results.

3.3.2) The Alum-tawed Leather Armour

The second section of replica armour to be tested was the alum-tawed replica section of scale armour (Fig. 66) based on Tutʿ Ankhamūn's leather cuirass. The manufacture of this section was begun after the first examination of Tutʿ Ankhamūn's armour in the Egyptian Museum, Cairo. Upon first examining the armour, it was thought that the scales were possibly made of alum-tawed leather, and based on this a section of leather was purchased and the armour manufactured. After the second examination of the armour, it was determined that Tutʿ Ankhamūn's armour is most likely made from rawhide, so as a result, the tawed leather was the incorrect choice. Nonetheless, it provides another a set of results based upon another material which can be compared to the results from the other tests. Five shots were made at the armour with the angular composite bow, using arrows made by the author and by Edward McEwen (see Table 3a: shots 4-8).

The first shot at the alum tawed armour was with an ebony pointed arrow. The armour was effective at stopping the arrow as it bounced off and fell to the floor at the base of the target. The damage to the armour was a small depression of approximately 4.0mm in diameter and approximately 2.5mm deep. The leather was compressed with no apparent corresponding bulge showing on the back of the scale. The arrow did not penetrate through either the first scale or the second beneath it, with the damage itself confined to a compression of the leather only with no visually apparent breakage of the fibre structure.

The second shot, again with an identical arrow (ebony point) also bounced off of the armour, dropping to the floor at the base of the target. Upon striking the armour, the arrow slid horizontally to the right passing underneath a scale, slightly tearing the leather at the edge of scale that it struck. The arrow did not penetrate the linen backing of the armour, but did fray the fibres of the uppermost layer. The damage to scale that was struck was a shallow gouge 2.5mm wide, 5.0mm in length, and 1.5mm deep, with a very faint dark streak 6.0mm long (left by the ebony wood abrading against the leather) leading into the damaged area. Although no significant damage to the armour resulted from this shot, it shows the inherent weakness in this design for armour: a weapons strike may pass beneath the scales at an oblique angle.

The third shot at the alum-tawed leather armour involved using one of the arrows made by the author which was fitted with a sharp bronze point. This arrow penetrated the armour, arming jacket, and martial-arts punching bag to a total depth of 129.0mm. The arrow struck the armour on the third row of scales at a point just below the points of the scales of row #2 and above the underlying scales in row #4. As such, the arrow only passed through two thicknesses of leather rather than a possible four layers. The damage to the armour was a single clean cut through the scales. This amount of damage to the armour and the target as represented in this shot would most likely have caused a life-threatening wound in battle.

The fourth shot at the alum-tawed leather armour was with an arrow made by McEwen, fitted with relatively blunt bronze point. The arrow bounced off of the armour, dropping to the floor below. The arrow struck squarely in the middle of a scale, the leather of which was compressed by the impact but not cut. The damage to the scale was a conical depression 4.0mm deep and the diameter of the width of the scale (20mm). The leather of the scale was deformed, leaving a bulge on the back of the scale. The depth of the damage and the height of the corresponding raised bulge on the back of the scale are difficult to accurately measure due to the flexible nature of the material, but it is noticeable to the naked eye that the bulge is not as great in height as the depth of the depression on the front of the scale. A tiny fragment of bronze remained at the bottom of the depression and measured no more than 1.0mm by 0.5mm by 0.2mm. It is not certain whether this speck of bronze was a fragment remaining loosely attached at the tip of the arrowhead after the manufacturing process or a small piece broken off as a result of the impact. Upon examining the arrowhead after the shot, the missing piece was not noticed and was only found upon examining the armour at the conclusion of this stage of the experiments. Aside from this tiny fragment of bronze, there was no apparent damage to the arrow.

The fifth shot was conducted with the same equipment and the same manner as shot #4. The shot struck a scale and left a conical depression that penetrated the scale but left both the scale beneath and the linen backing without a trace of damage. The raised bulge on the back of the scale, corresponding to the depression on the front, appears to be of less height than the depth of the depression. The penetration is a hole of approximately 1.2mm in diameter and is, upon examination aided by a magnifying loupe, the result of the point of the arrowhead both cutting and crushing the fibres of the leather. There was no apparent damage to the arrow as a result of this shot.

The very light damage to the alum-tawed leather scale armour when shot with arrows fitted with blunt (McEwen's ebony-pointed arrows) or relatively blunt (McEwen's bronze-pointed arrows) does not suggest that a person wearing this armour in a similar situation would escape the same shot unharmed. In such a situation there would be a considerable transference of energy as blunt trauma through the armour due to the flexibility of the material. Several of the leather laces holding the scales together were broken during the experiments, which shows that the armour was locally compressed beyond the tensile strength of the lacing, a fact that suggests that considerable force was transferred through the armour, and may have resulted in broken bones for the wearer of a similar armour in antiquity. The deep penetration of this armour with the arrow tipped with a sharp bronze point would have resulted in less transference of energy as blunt trauma than the other four shots due to the very sharp point cutting the material of both the armour and the target below. Despite the decreased blunt trauma, the resulting deep "wound" to the target from shot number three would likely have been the greater human injury by comparison. These experiments show that, compared to the tests involving the replica Sea Peoples' armour, that the alum-tawed leather scale armour was more effective against archery when blunt bronze points or ebony bodkin-points were used.

3.3.3) The Bronze Armour

The section of replica bronze armour was tested in the same manner as the alum-tawed leather armour. The same wool arming jacket as described above was used as an undergarment covering the punching bag (Fig. 67). The armour was tied onto the target with nylon laces running through the loops sewn to the corners and sides of the linen backing material. The laces tied on the back of the target did not interfere with the face of the armour in any way (see Table 3a: shots 9-13).

The Yorkshire Television Company (David Wilson [Director] and Melanie Davis [producer]) camera crew, during work on filming the "Arms in Action II" documentary for the

Royal Armouries, recorded slow motion film footage of the arrows striking the target at approximately 1000 frames per second. The Egyptian composite bow manufactured by McEwen (see Appendix 4) will cast an arrow at approximately 45 metres per second (see Miller, McEwen, and Bergman 1986: 179) which would translate into approximately 4.5cm of arrow travel per film frame. The camera was positioned approximately 4.5m from the target at an angle of approximately 30° from parallel and focussed closely on the armour to capture footage of the amount of damage and compression of the target upon impact. It has not yet been possible for the author to obtain this footage for analysis.

The first shot at the bronze armour was again with the angular composite bow and an ebony-tipped arrow. The arrow struck the armour and bounced off, falling to the floor at the base of the target. All three laces holding the scales in the row were broken and the scale that was struck was severely bent, while the adjacent scales were slightly bent. As well, one scale was torn free from the armour. There was no penetration of, or damage to, the linen backing, and the ebony point was cracked and mashed upon impact and was rendered unusable for another shot. This was arrow was trimmed approximately 1.5 cm and made useable again for the second stage of the experiments.

The second shot used one of the arrows made by the author which was fitted with a sharp bronze point (arrow #10). Upon striking a scale, the impact of the arrow broke all the lacing between the two adjacent scales to either side, and bent several of the scales to varying degrees. The arrowhead was badly damaged upon impact, the forward half curling up on itself a full turn (Fig. 68b). The rearward half of the point remained straight while the forward half curled significantly, causing lateral stress cracks to appear. The tang of the arrowhead cracked and bent to an angle approximately 45° out of line with the foreshaft but did not break off. The foreshaft itself broke at the tang and only remained connected to the arrowshaft by the binding thread. The arrowshaft, aside from the tang of the foreshaft being broken off inside, remained undamaged and could be fitted with a new arrowhead/foreshaft assembly and reused.

The third shot again used an arrow made by the author which was fitted with a sharp bronze point (arrow #7). This shot struck the same location as the second shot and caused further damage to the area resulting in another scale being bent. This shot also further damaged the laces causing a second scale to fall off of the armour. The arrowhead was bent in a similar manner to shot #2, but not as severely. The forward-most quarter of the point has been rolled over to c. 90° to the axis of the arrow and shows, to the naked eye, one small stress crack (Fig. 68a). The point was broken off at the tang and came away from the foreshaft, and the foreshaft broke at the tang and came away from the arrowshaft. The arrowshaft itself remained undamaged save for the remains of the foreshaft fixed into the socket at the forward end. The arrow could be easily repaired for further use by removing the broken tang of the foreshaft and inserting a new arrowhead/foreshaft assembly.

The fourth shot at the bronze armour was with an arrow made by McEwen and, fitted with a relatively dull bronze point. The scale that was struck was severely bent but remained attached to the armour as it was stitched to the linen backing through the uppermost hole. The scale to the left of the one that was struck was slightly bent and was torn away from the armour, as was the scale to the right, although it was not damaged. The laces of a section of seven scales (three to either side of the impacted scale) were damaged, some being abraded and others broken. The arrow remained undamaged except for the tip of the point being slightly dulled by the impact. This minor damage could easily and quickly be fixed rendering the arrow useable.

The fifth shot again used an arrow made by McEwen fitted with a relatively dull bronze point. This shot bent three scales considerably and broke the lacings to either side of the strike zone, and the scale to each side of the one struck were torn from the armour. Some laces were broken in the row of scales directly below the row that was struck. The arrow remained intact with only the point of the arrowhead being slightly dulled, again a situation which could be quickly fixed.

The arrows made by the author for the experiment did not perform as well as had been expected. The bronze scale armour, rather than the target below, seems to have been most damaged by being struck with the heavier dull bronze points made by Edward McEwen. The linen backing of the armour remained completely undamaged from the five shots, and it appears that the momentum of the arrows was entirely expended upon the bronze scales, which bent in response. The target did not appear to move as much as it did whilst testing the alum-tawed section of leather armour, which suggests that the weight of the bronze armour helped to absorb the energy transferred by the arrow upon impact. The results of the experiment suggest that the bronze armour in the ancient eastern Mediterranean would have been very effective at protecting the wearer from arrows shot from angular composite bows regardless of what type of points the arrows were fitted with. This may indicate that sharp bronze arrowheads were more effective against soldiers wearing leather or rawhide armour than against those wearing bronze armour. That the dull bronze points manufactured by McEwen were more effective than the sharp points may tentatively suggest that arrowheads may have been chosen in the Late Bronze Age according to what type of target they would be shot at, much as with arrowheads used for hunting.

3.4) The Second Session of Experiments at H.M. Royal Armouries Museum - 8/12/2000

During this stage of the experiments it was possible to obtain video footage of the arrows striking the armour for shots 14 through 33. To examine these files remove the CD rom from the envelope at the back of the thesis and place it into the CD rom drive of a PC and open the Windows Media Player. Select "File", "Open", and double-click on the relevant file name (i.e. *SHOT_18.m1v*). The video file should then play. Selected sequences have been removed from these files where noted (i.e. *Shot_18_Sequence.jpg*) and can be viewed with an image editing program or with an internet browser by simply double-clicking on the file name. The Sequence files capture five or six frames from the video clips at the moment when the arrow strikes the armour.

3.4.1) The Un-armoured Target

For the second session of the experiments (conducted 8/12/2000), two draw lengths were employed to assess the differences that might arise from an increase in velocity of the same arrows against the same sections of armour. Draw lengths of 745mm (29.33 inches) and 845mm (33.25 inches) were employed as this represented the standard draw length for the author, and the maximum length to which the replica arrows could be drawn. The shots at the armour involving the shorter of the two draw lengths were conducted by the author while the shots employing the longer draw length were done by Andrew Bodley (the Stablemaster at H.M. Royal Armouries Museum) who is accomplished in the Japanese Kyudo style of archery, and accustomed to a much longer draw length than is used in modern western archery. A Mediterranean style of release, as discussed above, was employed by both archers to avoid entering another variable into the experiments. The extra 100mm (3.9 inches) draw length allows the bow to "stack" to a greater weight and consequently store more potential kinetic energy which is then transferred to the arrow as momentum upon release. This increase in momentum will, upon impact, produce a greater depth of penetration, as can be seen in Tables 3b and 3c ???.

To assess the effectiveness of the various types of armour tested, several shots were made at the martial arts punch-bag which was covered with only a thin linen shirt (Fig. 69, beneath the rawhide scale armour). The depths of penetration of the various shots were duly recorded to provide a base line of the potential penetration that could be achieved by any of the arrows.

Seven shots were made at the un-armoured target, using a variety of arrows and the two aforementioned draw lengths. The depths of penetration can be seen in Table 3b (shots 14-17) and Table 3c (shots 31-33). It is noticeable that greater depths of penetration occurred with the greater draw length, and corresponding greater momentum imparted to the arrow. This factor appears to exist throughout the second session of the experiments where the arrow successfully penetrates the armour. Video footage of these shots, and captured frames of the arrows striking the armour, may be examined on the CD-rom included at the back of the thesis.

3.4.2) The Rawhide Scale Armour

A total of seven shots were made at the replica section of rawhide scale armour (Fig. 69) (Table 3b: shots 18-20, and Table 3c: shots 24-27. See also the video footage on the CD-rom [*SHOT_18.m1v* to *SHOT_20.m1v*, and *SHOT_24.m1v* to *SHOT_27.m1v*]) with the three types of arrows, each used at the two draw lengths as described above. With the shorter draw length of 745mm (29.33 inches) the ebony-pointed arrow did not penetrate the armour, while at the longer draw length of 845mm (33.25 inches), this arrow penetrated to a depth of 40mm. This difference shows the greater momentum of the arrow and the increased effectiveness of the longer draw length, and that rawhide scale armour is effective against most all except a long draw length at very close range.

The three shots using the bronze-pointed arrows made by McEwen were also made using the two draw lengths. The first shot, at the 745mm draw length, penetrated the armour to a depth of 15mm, showing that the rawhide armour was fairly effective at stopping a relatively blunt projectile. The two shots at the longer 845mm draw length using McEwen's bronze-pointed arrows show a great difference in penetration. The first shot (#25) penetrated to a depth of 70mm as it passed through the same hole as shot #24, which had been made by the ebony-pointed arrow. The second shot with McEwen's bronze-pointed arrow at the 845mm draw length struck an undamaged part of the armour and penetrated only to a depth of 7mm, which shows the effectiveness of the rawhide armour.

The final two shots at the rawhide scale armour were with the sharp bronze-pointed arrows made by the author. These shots penetrated to a depth of 63mm and 98mm respectively for the short and long draw lengths. The greater depth of penetration when using these arrows suggests that the form of the arrowhead, and how sharp it is, has a direct correlation to the depth of penetration of the armour that may be achieved.

3.4.3) The Composite Rawhide / Bronze Armour

Six shots were made at the replica section of composite bronze/rawhide scale armour (Fig. 70)(Table 3b: shots 21-23 and Table 3c: shots 28-30. See also the video footage on the CD-rom [*SHOT_21.m1v* to *SHOT_23.m1v*, and *SHOT_28.m1v* to *SHOT_30.m1v*]). Each of the three types of arrows was shot at the armour with the short (745mm) and long (845mm) draw lengths. None of the six shots penetrated this section of armour, suggesting that the inclusion of bronze armour scales along with the rawhide scales improved the effectiveness of the armour considerably as compared to the section of armour made entirely from rawhide scales.

The shots at the armour using the ebony-pointed arrows bent the bronze scales slightly, and in the case of the longer draw length, two rawhide and one bronze scale were torn away from the armour. In both shots the ebony points were damaged. In the shot at the shorter draw length, the ebony tip was broken off of the arrow-shaft at the join, and in the shot at the longer draw length, the tip of the second ebony-pointed arrow was slightly crushed.

The two shots using McEwen's bronze-pointed arrows bent some of the bronze scales, and in the case of the shot using the longer draw length, tore one scale free from the armour. The arrows remained undamaged in these shots.

The final two shots using the sharp bronze points also did not penetrate the armour, but a few of the bronze armour scales were slightly bent as a result of the impacts. The arrows suffered severe damage in these two shots with the first shot (at the shorter draw length, arrow #5) bending the forward third of the bronze point in a 180° curl, and breaking the point away from the foreshaft (Fig. 71a). The shot made with the longer draw length (arrow #6) bent the forward third of the bronze point through a 270° curl, but did not break the point away from the foreshaft, nor did it break the foreshaft away from the arrow-shaft (Fig. 71b).

3.5) Interpretations and Conclusions

During the manufacture of the scale armour it was discovered that the whole process is exceptionally time consuming. The manufacture of the alum-tawed leather armour scales was very likely similar to the techniques employed in the Late Bronze Age, using no modern machinery except for the spokeshave, and thus may not have been much slower than in the ancient world. The bronze, rawhide, and composite sections of armour were, however, produced much more quickly with the aid of the drilling jig, press, and electric metal guillotine. Production of the sections of armour was initially slow due to the steep "learning-curve", but increased somewhat with practice. Certainly, a skilled Late Bronze Age craftsman who specialized in the manufacture of armour would have been able to produce scale armour much more quickly.

During the production of the sections of armour, it became clear that the speed which the armour could be produced would have been a determining factor in the total number of coats available for use in the military. As each of the three sections of armour (bronze, rawhide, and composite) took approximately 30+ hours to make (accounting for the author learning the necessary steps), a coat of armour with 1600+ scales would take at least 48 hours to manufacture with modern machinery (see Chapter 3.1.3.6) and almost certainly much longer with Late Bronze Age tools and techniques. As the ancient world certainly did not make use of the modern machinery used in these experiments, the amount of time needed to manufacture the armour would have been greatly increased. Casting the bronze into sheet form, cutting out the individual scales, and drilling or punching each lacing hole individually would have greatly increased the effort and time involved in the manufacture. It is possible that the stages of manufacture were separated into the component stages, specialists manufacturing the component parts which were then shipped to specific craftsmen. This diversification of labour is noted in the Nuzi texts (i.e. HSS XV 195, 196: 14f), the manufacture of armour involved production by the *nappaḫu* smiths, the *aškapu* leatherworkers (Kendall 1974: 126), and obviously the weavers who manufactured any textiles that were used. The leatherworkers seem to have had the task of assembling the armour, which may suggest that more leather was used in the construction of a coat of armour than metal, as it was their task to assemble the armour rather than that of the smiths.

The effectiveness of the armour varies with the form of attack which it is to protect against. The rawhide armour was quite effective at stopping relatively blunt projectiles whilst it did not serve as well against the sharp bronze points. Given the effort in manufacturing finely made bronze points (see Appendix 5), it may be hypothesised that this "costly" style of arrowhead was not always in use. The effectiveness of ebony bodkin points against an unarmoured soldier is well attested by the remains of the approximately 60 XIth Dynasty soldiers found in a tomb in the Neb-ḫepet-Rē cemetery at Deir el-Bahri, at least 10 of which retain remains of ebony bodkin-pointed arrows which were almost certainly the cause of death (see Winlock 1945). These soldiers are believed to have been shot at relatively close distance from the battlements of a fortress, and none had injuries resulting from hand-to-hand fighting (Winlock 1945: 14-15, 23). Some of the injuries involved arrows that achieved considerable penetration, with one soldier having an arrow that had entirely transfixed the body, passing from the left side of the base of the neck through to the right side of the body, coming to rest just under the skin at the junction of the third and fourth ribs. There is no evidence that the individuals wore any form of protective armour, although this may be an instance which could have promoted experimentation in new defensive measures..

The tests were conducted at a distance of 7 metres, the theoretical minimum distance at which an archer would likely employ archery in a battle (John Waller, pers. comm.). The rawhide armour, which did provide some protection at 7 metres, would have become more effective at greater distances, as the arrows would lose momentum over distance during flight. The decreasing momentum of the arrows would allow the rawhide armour to provide some protection against even the arrows with sharp bronze points. The greater draw length used ("drawn to the ear") also made quite a lot of difference, but the further away the archery from his target, the slower the arrow will be, and the less potential damage it could cause due to a decrease in kinetic energy. This fact must have been intrinsically known to the warriors and archers of the Late Bronze Age: not perhaps the mathematical principles, but certainly the overall effects.

The effectiveness of the bronze and composite bronze/rawhide armour, even at close range, suggests that this armour would have been suitable for use even in the most hazardous conditions. In such situations, the high cost of manufacturing this style of armour may have been justified. The elite association with metallic armour (see Chapters 2 and 5), may also have caused small numbers of this style of armour to appear on the battlefields of the Late Bronze Age. As both the bronze and composite sections of armour stopped all of the arrows shot at them, the difference in the weight of the two sections of armour becomes a notable factor. The scales on the section of bronze armour weigh a total of 2.916kg while the 250 scales (125 bronze, 125 rawhide) on the composite coat weigh 1.701kg, thus representing a 41.66% reduction in scale weight without any apparent loss of protection. The rawhide scales in the composite section of scale armour appear to have had a buffering effect for the bronze scales. It appeared that fewer laces were broken upon similar impact when shooting at the composite armour. This factor was an added bonus in the composite coats of armour, as not only would the weight and manufacturing time of the composite armour be decreased, it would also provide some very small added protection as fewer armour scales would fall from the armour.

Altogether, these factors very strongly support the hypotheses presented in this thesis for the existence of composite scale body armour. The composite coats of scale armour would afford the same level of protection, increased mobility (over an all-bronze coat) and a decrease in the cost of manufacture. Furthermore, this may explain the coats of armour noted in the Nuzi text in which, i.e. the front is made of leather and back of bronze (see Kendall 1981: 201, see also Chapters 1.4.3 and 5.1). The tests also show that leather armour was quite effective and probably a very useful item due to the decreased weight, decreased manufacturing time, and fairly high degree of effectiveness.

The weakness of this style of armour can, however, be seen in Shot #2 at the alum-tawed leather armour where the arrow slipped sideways and went under the scales. The armour used in the tests utilized scales which all overlapped in the same direction, thus making it easier for an oblique shot from the left of the armour (when facing the target) to slip beneath the scales. This was not specifically tested in the experiments, although the shot mentioned above shows that this could have occurred. The Biblical passage "And a certain man drew a bow at a venture, and smote the king of Israel between the joints of his armour..."(1 Kings 22:34-35), may refer to such an event. This is also the most likely explanation for the rows of scales in the armour from Tutʿankhamūn's tomb which overlap in the opposite direction. This approach was almost certainly used in other coats of scale armour, as scales with the mirror-image lacing hole patterns necessary to make rows overlapping in the opposite direction are found at many sites, most particularly at Kāmid el-Lōz.

The flexible nature of the rawhide scales in the rawhide and composite sections of armour also seem to have provided some protection for the lacing. A surprising number of laces were broken in the all-bronze section of armour when it was struck with the arrows, the sharper, inflexible edges of the lacing holes in the bronze scales seeming to cause the lacing to break more readily on impact than in the other sections of armour that were tested. In the rawhide and composite sections, the rawhide scales appear to have had a cushioning effect, thus protecting the lacing. In this sense, the rawhide and composite armour therefore appears to require a slightly lower level of maintenance.

Over the total area of the bronze, rawhide, and composite sections of armour there are four thicknesses of scales. This structure also allows the armour to flex upon impact, distributing the force outwards, yet provides a thick enough mass of scales which are pushed against one another at the point of impact, providing protection to the target beneath. The video footage of Shot #29 (*SHOT_29.m1v*) and the frame-by-frame images (*Shot_29_Sequence.jpg*) of the impact shows the armour in the lower right area of the section rippling outwards from the point of impact, thereby distributing the force over a larger area. The greater mass of an all-bronze coat of armour would also serve to decrease the impact damage suffered by the wearer, but at an increase in cost and a decrease in mobility. In some of the shots at the bronze and composite sections of armour, the arrows struck areas which had been damaged by previous shots, but still provided adequate protection, stopping the arrows from penetrating the target beneath.

The armour tested in this set of experiments has conclusively shown that scale body armour in the Late Bronze Age Middle East was not simply an item of conspicuous consumption. The level of protection afforded by even an all-rawhide coat of armour would have made this armour suitable for use in certain circumstances. Archers, charioteers, and perhaps a select group of elite infantry soldiers could have made use of this armour should their tasks have taken them into situations where their being struck by weapons would have been likely. Due to the complexity of the armour, and the associated high costs of production (in time and effort), it is also certain that the armour was involved in some aspects of elite conspicuous consumption (see Chapters 2.4 and 5.3.2), however it was, without doubt, a functional item of military hardware.

The experimental work presented in this chapter shows that scale body armour was an effective item of military equipment. The material from which the armour scales were made governs the effectiveness of the armour, with bronze being the most effective but also weighing the most. The composite bronze/rawhide armour was as successful at stopping arrows as the armour made with only bronze scales, while the rawhide nd alum-tawed sections of replica armour were most effective against the ebony bodkin arrowheads and the dull bronze arrowheads. It is probable that the rawhide and alum-tawed sections of scale armour would be more effective at stopping the sharp bronze arrowheads at a greater distance. The relatively poor performance of the Sea Peoples' style replica armour was partly due to the material (waxed leather rather than rawhide), but this too may show that this style of armour provided more protection against blunt trauma than against penetrative projectile weaponry, and as such may suggest that the combat situations to which it was suited did not often involve archery. This chapter suggests that considerable savings in weight could be achieved through the use of rawhide whilst only sacrificing a relatively small degree of protection. The equal effectiveness of the bronze and composite bronze/rawhide armour suggests that a coat of armour made only with bronze scales may have been intended as much for protection as conspicuous consumption, as there would be no quantifiable increase in protection for the added weight.

Chapter 4

Commentary on the Catalogue: The Archaeological Data - Pattern and Context

The purpose of creating the catalogue has been to provide a comprehensive corpus of information on all of the scale armour finds from the Late Bronze Age Middle East. It must be noted that there are very few finds included from the Aegean as the use of military equipment there (i.e. chariots, armour) is of a different nature than in the Middle East (see Drews 1993, Dickinson 1999).

4.1) Particulars and Noted Points of Potential Errors in the Database/Catalogue

Based on the examination of the database, the majority of the scale armour found in the Middle Eastern Late Bronze Age comes from five sites: the tomb of Tutʿankhamūn, Kāmid el-Lōz, Boğazköy, Ugarit, and Nuzi. Four of these sites, excluding the tomb of Tutʿankhamūn which will be discussed below, account for 83.2 % of the armour scales in the database (416 of 500 database entries). This problem leads to a skewed sample which does not represent equally the whole of the Middle East, making it difficult to analyse the data below. Errors caused by this factor are indicated where they have been recognized. The precise number of entries in the catalogue (500 entries) is a number which has occurred simply by coincidence, and does not reflect an attempt to present a specific, rounded number of examples. There are examples where only one scale is presented in the excavation reports to serve to illustrate all of the other examples found, and in these cases, the database will have only one entry but may refer to more than one example (e.g. database entries *Tel el-'Ajjul III KB=1140*, *Tel el-'Ajjul III KK=1080*, *Tell al-Fakhar 1* and *Tell al-Fakhar 2*).

In addition to the above, much of the armour has been found in contexts which have seen post-depositional disturbance. For example, the coat of armour from Tutʿankhamūn's tomb was disturbed shortly after the pharaoh was interred, and was further disturbed when the priests restored order to the tomb and its artefacts and resealed it (Reeves: 1990:95-97). As described above (see Chapter 2.3.3), it is likely that Tutʿankhamūn's armour was one of the artefacts that was disturbed by these actions. Consequently there is a lack of information as to the precise association of this coat of armour with the surrounding artefacts.

A similar situation exists with the site of Kāmid el-Lōz. In this site the burials have been disturbed post-deposition by an earthquake (and possibly other means) with the result that many of the artefacts are scattered across the room which served as the tomb (Ventzke 1983:161, Hachmann 1989: 111). Should this site have remained undisturbed, it may have allowed the assessment of the original structure of the armour and perhaps have provided some further proof of the existence of composite organic/metallic armour. As the armour was found scattered across the room, it is unclear if some of the copper-alloy scales are missing, or if the remainder of the armour was organic.

Much relevant information is also missing from the database due to inadequate recording at the time of excavation and at the time of publication. Many of the armour scales are poorly published, being mentioned in passing in the texts, but not illustrated. Quite often there are no measurements provided nor are there depictions of the scales from which measurements may be taken. Often, in the older publications, if there is a drawing or photograph of the scale, there is no measurement scale provided with the depiction from which to derive measurements. As the measurements and lacing pattern are of direct importance to this study, this missing information is problematic. Even though little can be learned of these armour scales, they have been included in the database simply to acknowledge their existence and provide some measure for assessing the distribution of scale armour across the Middle East.

Lack of detailed information on associated finds and types of contexts in which armour scales have been found particularly plagues publications from the first half of the 20th century. These publications are often the same ones which do not include any information on the appearance of the armour scales (i.e. measurements and depictions). Again, these scales have been included in the database simply to acknowledge their existence. However, it must be noted that in some of the analyses below, these scales have been omitted. Furthermore, the scales from Nuzi which Kendall (1974: 268) names as "Type 1" and a few select others are omitted from the analyses (for an example of this form see database entry "Nuzi 1930.76.22"). This has been done as there is no conclusive proof that they really were armour scales. Starr (1939: 476) and Kendall (1974: 268) both have assumed that the unperforated rectangular scales found at Nuzi belong to some form of armour. This is certainly possible, but due to the fact that they are unique to Nuzi with no comparative information (texts, artistic depictions, etc.) in the Late Bronze Age Near East, they have not been included in the analysis. Only the armour scales which have been perforated for lacing figure in the discussion below due to the lack of significant collections of other forms (such as the Nuzi Type 1 scales).

In an attempt to determine the appearance and construction of the armour scales and finished coats, the author has examined the armour found in the tomb of TutʿAnkhamūn, and the armour scales found at Malqata, Lisht, and Nuzi. Due to restraints enforced by the curators and conservation efforts at the Egyptian Museum, the examination of TutʿAnkhamūn's armour was insufficient to allow collection of data for every scale (see Chapter 2.3.3.1). A selection of 14 scales from TutʿAnkhamūn's armour has therefore been included in the database to represent the armour find.

Difficulties have also arisen with the examination of the contexts in which the various armour scales in the database have been found. Several site reports lack detailed information on the contexts, and several armour finds are from contexts which are of an indeterminate type. In addition, certain associations of artefacts with the armour are in contexts which are difficult to assess. As an example, the armour from TutʿAnkhamūn's tomb is associated with a vast number of other artefacts (a total of 620 artefact groups in the tomb; see Murray and Nuttall 1963), and as a royal burial is a situation which is most certainly not representative of the other armour finds in the Late Bronze Age Middle East.

In certain instances armour scales are allocated two context types when they are from an uncertain, but not unknown, context. For example, an armour scale found in a large well-made building which may be either a public building or a domestic unit, but is definitively neither one nor the other. In a similar situation, armour scales found in contexts which are designated as the excavators as palaces are placed in the category "Public Building" as there are textual references (i.e. from Nuzi and Ugarit) to a wide range of individuals being present in such buildings. It is taken here that these non-royals represent the "public" as the armour scales may as easily have been deposited by their actions as by the actions of the elite residents of the palace.

4.2) The Structure of the Catalogue

Note: The catalogue is to be found on the CD-rom included at the back of this thesis. The database has been compiled with the Microsoft Access 97 program, and this program (or a more recent version) will be needed to examine the catalogue. The database has been given the file-name "*Late Bronze Age armour*" and can be found within the directory also of this name. Within the database are three main data entry forms named "*Scale Descriptive Data*", "*Contexts*", and "*Publication/Illustration*". Each of these forms has 500 pages, one for each armour scale in the catalogue. Various queries are present within the database which relate to these forms and their parent tables (named *measurements*, *contexts*, and *misc*). An abridged digital catalogue may be found within the "Reports" section of the Microsoft Access 97 program, and it contains the most pertinent data for each armour scale.

4.2.1) The "Scale Descriptive Data" Form

The *Scale Descriptive Data* form includes all of the relevant measurements of each individual armour scale and all available information on the physical characteristics. There is also a field entitled "Method of Manufacture" in which relevant comments on the manufacturing process employed have been entered where this information is available. The field titled "Comments on Measurements" contains information on the length, width, and thickness of the scale which are often duplicated in the numeric fields. Furthermore, for scales which are fragmentary, there is generally information on the surviving length and width which are not included in the numeric fields. The field titled "Comments on Appearance" contains a description of the physical characteristics of the scale which are not included in the true/false tick-boxes. Within the *Scale Descriptive Data* form are two fields labelled "Upper Edge Shape" and "Lower Edge Shape". The entries on these fields are "Square" or "Rounded" for the former category and "Square", "Rounded", or "Pointed" for the latter. With scales where the upper or lower edge shape is unknown, i.e. missing or unknown due to having not been included in the excavation report, the edge shape is termed "Unknown". Where the tick-box labelled "Fragment" exists, this is checked if there is less than 50% of the armour scale remaining.

The term "lacing pattern" refers to the pattern of holes in the surface of the armour scales by which the scales are laced together prior to the rows of scales being fixed to a linen or leather backing. The possible lacing patterns are depicted in Fig. 72 and show a logical progression of types, each type with a mirror-image which would be laced together in the same manner, but with the scales overlapping in the opposite direction. Within the catalogue *Scale Descriptive Data* form is the field titled "Lacing Pattern" which refers to Fig. 72 where a numeric code is given to a wide selection of possible lacing patterns. In cases where an armour scale is assigned the number **0** (zero), this refers to an unperforated armour scale. The lettered code **IR** refers to an irregular, and usually unique, pattern of lacing holes not included in Fig. 72. The code **U** refers to perforated armour scales for which no information exists on the pattern of the lacing holes. The code **BR** refers to broken armour scales which have sections missing which may have contained lacing holes, thus making it impossible to determine the original lacing pattern. In cases of broken armour scales where the break passes through one or more lacing holes, but do not obscure areas where other lacing holes would have likely been present, the appropriate lacing hole pattern code number is used. In cases where the lacing pattern is of a form which is not represented in Fig. 72, there is generally a description of the lacing pattern in the "Comments on Appearance" field.

4.3) The Date Codes Assigned to the Armour Finds

In Fig. 73 the dates allocated to the armour scale finds by the excavators have been given a simple numeric code in a chronological order as follows:

1) 1210 - 1100 BC
2) 1320 - 1210 BC
3) 1430 - 1320 BC
4) 1540 - 1430 BC
5) 1650 - 1540 BC

The date codes above are broken down into 110-year blocks to better represent the data, but do not reflect any specific accepted time periods acknowledged by the excavators (i.e. Late Bronze Age II, etc.). In cases where the artefacts are allocated to large spans of time (i.e. 1500 -1300 BC), and to avoid having groups of artefacts straddle two or three of these artificial time periods, an average date for each distinct group of armour scales has been established and the relevant date code then allocated (see Fig. 73)). This has been done to provide a simple numeric framework for creating charts for the analysis of the data on armour scale sizes vs. date, and for analysing the lacing patterns vs. date. As none of the armour scales fell into Date Code 5, it is not represented in the database and only appears as an empty field in the graphs and figures associated with this chapter. In Fig. 73 the longer time periods (i.e. Late Bronze Age II) are represented as blocks of red which fade out towards the ends, thus indicating a lack of absolute dates for the beginning and end of the possible chronology of the particular archaeological sites. Red points have been included in the graph indicating examples where specific dates have been given for the armour scales.

4.4) Discussion of the Archaeological Sites

A map showing the locations of all of the archaeological sites at which armour scales have been found is included as *Map 1* and is located at the beginning of the Figures at the back of the thesis.

4.4.1) Alalakh

Two armour scales were found at Alalakh, both in contexts which are here determined as having been Domestic Units. One scale was found in House 37/A, Room 11 (stratum IV, c. 1447-1370 BC) which was a unique house as it had a pair of mud brick half-columns flanking the entrance. This is an unusual feature for a relatively small private house, and is to date unique amongst the buildings at Alalakh (Wooley 1955: 278). This is possibly indicative of a wealthier home, and thus further strengthens the hypothesis of scale body armour being associated with the wealthy elite.

The second armour scale was associated with Room 4, House 38/B (Stratum Ib, c. 1273-1194 BC). The armour scale, and the associated pottery, were not found at floor level in this room, as there was no distinct preserved floor. It is assumed here that Wooley (1955) has dated the scale via its association with the Late Minoan ceramics. Wooley (1955: 278) states that the scale was located not on the floor level of Level IV, but in the debris some 50cm below the top of the standing wall, and was therefore contemporary with the destruction of the palace. It may be possible that the armour had originally been stored on an upper storey.

4.4.2) Beth Shan

Five armour scales, or fragments thereof, were found at Beth Shan in a variety of loci. Two scales were found in Temple/Sanctuary contexts. One scale was found in Locus 1085 in

Stratum VII (Late Bronze Age II assigned to Date Code 3 - c. 1430-1320 BC). This loci was part of the south-eastern room opening to the enclosed inner courtyard of the Level VII temple. The room was approximately 5 metres long (North-South axis), and ranged from 5.6 metres wide on the north wall to 4.0 metres wide on the south wall with the opening to the courtyard being 3.6 metres wide., LBII, DC3. The other scale was found below the steps of Locus 1068, Stratum VIII (Late Bronze Age II assigned to Date Code 3 - c. 1430-1320 BC). This context is also believed to have been an altar room of a temple, and as such the artefacts were possibly deposited here as offerings (James and McGovern 1993: 213). The inclusion of the armour scale, which was perhaps originally part of a complete coat and made of a non-precious material, as an offering is understandable when compared to all the other items made of precious materials, and is similar in this sense to the inclusion of the coats of armour in the Amarna dowry lists (see Chapter 5.3.1).

An armour scale fragment (later discarded) was found in Locus 1260, Stratum VII (Late Bronze Age II assigned to Date Code 3 - c. 1430-1320 BC). The context of this locus is uncertain, but it was within a building which may be associated with a Domestic Unit as the armour scale was found near a tabun baking oven (James and McGovern 1993).

The final 2 scales were found in Locus 1315 in Stratum VIII (Date Code 3 - c. 1430-1320 BC) which was part of the eastern and north-eastern periphery of the excavations, and was a poorly defined area, and no field records exist. The context in which the armour scales were found is unknown although Locus 1315 is positioned East of Room 1309 which may have been a large room or courtyard (James and McGovern 1993).

4.4.3) Boğazköy

A range of armour scales have been found at Boğazköy in a variety of contexts, and have been dated to three main time periods: 1500-1300 BC, c. 1280 BC, and c. 1200 BC. A single scale was originally tentatively dated to the 18th century, although there is no firm evidence for perforated armour scales from this time period. This armour scale was found in a context of unknown type, but was found in the ash and fire debris of Layer 4. Bittel (1958: 35) acknowledged that this type of armour scale was better known in the Middle East from the beginning of the 15th century BC. It is most likely that this scale was not in a secure, undisturbed context. It is most likely from the period c. 15th to 11th century BC and has through unknown means become associated with Layer 4 at Boğazköy. Date Code 3 has been allocated as the form of this scale is of standard Late Bronze Age style, and therefore an "average" Late Bronze Age date is assigned.

One other scale was found in an unknown context, in Büyükkale layer IV d. The scale was found in the lower city in layer 4 in the rubble from a destruction layer which had involved fire, and has been dated by Boehmer (1972: 103) to c. 1500-1300 BC and therefore has been given Date Code 3. Two scales were also found in a Temple/Sanctuary context in Büyükkale stratum III. The scales were found on the pavement of Temple I and have also been dated to c. 1500-1300 BC (Boehmer 1972: 103-104).

Thirty-three armour scales have been found at Boğazköy in association with Temples. Four were found in associations with storerooms in Temple I. One was found in an unstratified context on the floor of Storeroom 70, and another in the unstratified rubble in Storeroom 5. The thirds scale was found on the eastern side of Storeroom 9. The fourth scale was found in an unstratified context in Temple I in the east street in front of the storerooms (Boehmer 1972: 102-104). These scales have all been dated to c. 1500-1300 BC. A group of 29 scales were found in Stratum 3, Layer O, in a Temple/Sanctuary context in Temple VII in the southern half of the tell. As this group was found in association with a bulae/seal impression of Muršilli III, they have been dated to c. 1280 BC (Neve 1984: 370-371). The association of these armour scales with temple storage rooms suggests two possibilities: 1) The armour might have been part of coats of armour which had been dedicated as temple offerings and subsequently stored away, or 2) they may have been in storage as part of the uniforms of palace guards. The former hypothesis is the more likely, as the guarding of the temple would, as has been shown in the texts of Ugarit (see Heltzer 1982) and Nuzi (see Kendall 1974) to have been under control of the palaces, with the guards being outfitted through the palace armouries (see also Chapter 5).

A group of 59 Scales was found in 1982 close together on the floor of the Eastern Cellar in House 9 approximately 50 metres North-East of Temple VI. These scales have been assigned a Public Building context as Neve (1983: 438) suggests that House 9 may not have been part of the temple complex, but was nonetheless an important building due to its construction, height and large size. There were two slightly different types of scales which Neve (1983: 447) suggests may have come from more than one coat of armour. It is more likely that these scales all belonged to one coat, but the different sizes of scales were for different parts of the body. It is also possible that these scales are a large group from a composite coat of armour. The scales were found in Stratum 3, Layer O, and therefore date to c. 1200 BC.

4.4.4) Enkomi

Two armour scales were found at Enkomi in the 23rd season of excavation (1972). The two scales are of typical Middle Eastern Late Bronze Age style and are comparable to the scales from Alalakh and Ugarit, and the scale from Mycenae. The scales were found in between the stones in the north wall of Square 5 in Area 4W, and are probably associated with the first course of stone wall in the first stage of construction of the building.. The armour scales are thought to date to the 12th century BC and were found in Mycenaean stratum IIIc2 (Pelon and Lagarce 1973: 110).

4.4.5) Gastria-Alaas

Three small bronze armour scales, of a type which Karageorghis & Masson (1975: 209-211) state are from Near Eastern style body armour, were found in an unstratified level in Tomb 12. The tomb was disturbed at some point prior to excavation. Although the authors do not suggest where the armour was manufactured, they do state that the origin of the style is Asiatic, and probably Mesopotamian. The scales date to c.1400-1200 BC, and have therefore here been assigned Date Code 2.

4.4.6) Gezer

One scale was found at Gezer V in a disturbed context in the Lower Burial Phase 10A of Cave I. The cave was originally a water cistern (possibly begun c. 1600 BC), with the burial phase beginning not long after the cistern went out of use (c. 1450 BC). The burials in the cave began as primary burials on a raised "bench" of stones and rubble, which after decomposition were cleared for the next burial with the remains being piled in the back of the cave along with the grave goods that had been associated (J. Seger 1988: 60, 66). The disturbed group of grave goods (associated with the initial use of the cave) contained, amongst the pottery and other objects, a bronze armour scale, a bronze dagger, and 2 bronze arrowheads (Seger and Lance 1988: 157). It is possible that the armour scale was pat of an Late Bronze Age warrior burial, although little evidence exists to substantiate this (see Chapter 4.5.6). The skulls were generally displaced in an orderly fashion, but no attempt seems to have been made to keep the long-bones and grave goods together. The armour scale was found in Stratum XVII and therefore dates to c. 1450-1380 BC (Late Bronze Ib/IIa), and has been assigned to Date Code 3.

4.4.7) Kāmid el-Lōz

A large selection of armour scales were excavated in 1978 at Kāmid el-Lōz in Rooms S and T in area IJ17 with both rooms having almost certainly been tomb chambers. The vast majority of the armour (181 scales) was found in Room T with one scale having been found in Room S. The armour was scattered throughout the room and it is thought that there was one complete armour corslet upon deposition which was eventually broken up and dragged across the floor of the room, perhaps at different stages. It is likely that the armour was related to the adult male skeleton which was interred in the room, whose burial may have been that of an elite warrior, as there were 28 arrowheads, a dagger, a khopesh sword, and a large quantity of items made of precious materials (a total of 901 artefacts in the two rooms in addition to the ceramic remains), found in association with the armour (see also Chapter 2.3.3.1). It is very likely that the remains of armour in this tomb are part of the burial equipment of a warrior, a so-called "Warrior Burial" as described below (see Chapter 4.5.6).

Rooms S and T may have been left open to the elements, or left open for additional burials or ritual use, thus enabling the burial goods to be moved about either intentionally or unintentionally. Hachmann (1989: 118-119) suggests that the lack of enough armour scales to form an entire corslet may be due to the intentional removal of useable scales. It suggested here that this armour may originally have been a bronze/leather or bronze/rawhide composite suit. The armour was found in Stratum P4c and dates to c. 1475 - 1340 BC, and can be probably be more accurately dated to c. 1360 BC (Hachmann 1996: 21).

4.4.8) Lisht

Two armour scales were found at Lisht in a unique type of context. The scales were found along with a wide range of copper and bronze scrap metal, all of which were wrapped in a linen bundle sealed with a clay seal bearing the prenomen of TutʿAnkhamūn. This bundle was found within a reed basket in association with rubble 36 metres to the west of the entrance to the Middle Kingdom pyramid of Senwosret I (c. 1971-1928 BC), 1.3 metres in front of the line of the pyramid foot. It was found during the 1933-1934 Metropolitan Museum of Art (New York) excavations alongside the backing stone of the pyramid casing. It is assumed that the basket of bronze and copper scrap metal belonged to a "junk dealer" and was intended for recycling. It is suggested by Hayes (1934: 8) that it may have been part of a metalsmith's kit. Some of the bronze artefacts may have been from items dating to the Middle Kingdom, but most appears to be of New Kingdom Date, perhaps of the Thutmoside period (Hayes 1934: 8; Arnold 1988: 99). Hayes (1934) also suggested that a coppersmith may have placed the bundle near the pyramid, and lost it when the casing collapsed as it was removed by New Kingdom workmen. The bundle of metal is unstratified, but dates to the reign of TutʿAnkhamūn (c. 1334-1325 BC) due to the seal impression bearing part of his name.

4.4.9) Malqata

The ten scales from Malqata were found within the area of the Palace of Amunhotep III (c. 1386-1349 BC) at Thebes during the New York Metropolitan Museum of Art excavations in 1910-1911. These scales share the same basic form and style as all the other scales in this database, but are considerably larger. They could have been used to form the front or back of an armoured corslet intended for a warrior, but are more likely to have been used for the construction of an armoured coat for a chariot horse. The scales were found in an "XVIIIth Dynasty" Stratum and have been dated *terminus post quem* to c. 1386-1349 BC and assigned a context of Public Building based on their presence in Amunhotep III's Palace (see Shaw 1991: 42).

4.4.10) Megiddo

Three scales were found in Square AX/69, Level F9(a) on the northern edge of the tell's Lower Mound in association with ceramic remains of 24 distinct types. The main feature of Level F9, running through most of the excavation squares, was a well-constructed building with thick stone wall foundations, possibly able to have supported one or two upper storeys. A considerable degree of bioturbation (animal burrows, specifically mole rats (*spalax sp.*) have disturbed this context (Ilan, Franklin, and Hallote In: Finkelstein et al. 2000: 75, 78, 86). These armour scales may be transitional Late Bronze Age/Early Iron Age examples due to their appearance and have therefore here been assigned to Date Code 1 (c. 1210-1100 BC). A dual context of Domestic Unit / Public Building has been assigned as there is no evidence as to the precise nature of the building in which the armour was found.

One scale was found in Room 3102 (Area AA, Square K7, Stratum VIII) which is thought to have been a passageway to, or a room in, the palace (Loud 1948: 173). The scale has been dated by Kempinski (1989: 144, fig. 42) to c. 1520-1380 BC and has here been assigned Date Code 4 and given a Public Building context.

Three scales were found at Megiddo in Area CC. One scale each was found in Squares R9, Q9, and in R-S9. Although the type of building in which the armour scales were found is uncertain, Kempinski (1989: 83) believes that Area CC was residential, therefore these three armour scales have here been assigned to a Domestic Unit context. The scales were found in Stratum VIIa and VIIb and date to c. 1250-1140 BC and therefore are within Date Code 1.

4.4.11) Mycenae

One armour scale was found at Mycenae on 2 August, 1968 in the main baulk of the Citadel House (Stratum IIIc). Catling (1970: 441) suggests that this scale did not belong to a coat of armour which had its origins in the Aegean, and suggests the possibility that it was part of a coat of armour brought to Mycenae from abroad as loot or booty. This armour scale resembles, in all respects, a scale from the Late Bronze Age Middle East. The armour scale is here assigned a Public Building context, and is dated to the first half of the 12th century due to its having been found in association with Late Helladic IIIc pottery. This scale therefore fits into Date Code 1.

4.4.12) Nuzi

A wide variety of armour scales were found at the site of Nuzi in 1930. The armour scales came from a variety of different loci, however most of them were found in contexts which could be determined to have been Domestic Units having belonged to the wealthy elite. Each of the houses at Nuzi have been often identified by the cuneiform texts found within, and the excavation reports (Starr 1937, 1939: 333) make use of these names accordingly in describing some of the areas of the excavation.

A group of 36 armour scales was found in Room 18 of the house of prince Šilwitešup. This group was composed of 2 rows of 18 scales each and was found beneath a pottery jar. Close to this group of scales were two or three other smaller armour scales, although it is unclear which armour scales these are. Also found in Room 18 were 3 large rectangular scales which, due to their size, were probably from a coat of horse armour. One scale was found in Room 23, and another which is of uncertain provenience may have been found in Room 27, or in Room 2 in Šurkitilla's house. Šilwitešup's house was the second largest at Nuzi, and was certainly a high-status suburban dwelling (Starr 1939: 337, 342). The 36 fused scales found in Room 18 of prince Šilwitešup's house are also quite possibly from a coat of horse armour, due to their large size. They are almost the same size as the 3 large rectangular scales which Kendall (1974: 285-286) suggests were horse armour (see database entry *Nuzi 1930.76.8*)

Four armour scales, plus the one with uncertain provenience noted above, were found in Room 2 in Šurkitilla's house. Starr (1939: 335) also believed this house to be that of a wealthy citizen, and continued in suggesting that the large number of military items associated with the armour scales might suggest that this room served as the household armoury. Two armour scales were also found in Room 19 of the house of Tehiptilla.

A group of 25 armour scales was found in Room 34 in the House of Ziki, a building that was out of the bounds of the city of Nuzi, but had been encroached upon by the ever increasing size of the House of Šilwitešup. Starr (1939: 346) states that Room 34 in the House of Ziki was an architectural oddity in that the southwest and southeast walls contained round-topped niches, the largest of which contained a storage jar. Starr (1939; 347) also suggested that Room 34 was a general storage room rather than an armoury due to the large number of non-military items found within it. Furthermore, the fused masses of copper and the carbonized barley suggest that the room burned with great intensity, and probably before being looted, hence the large number of artefacts. This might suggest that the lower number of artefacts from similar rooms in the Šilwitešup's house are due to the house having been looted.

Two armour scales were found, one each in Fields 1281 and 1282. The armour scale found in Field 1282 is from Room 93, Stratum II, however, the excavation notes held at the Harvard Semitic Museum state that the location of Room 93 within the excavations is lost, it is possible that this armour scale is from Room 1 or 2 in the house of Šurkitilla, although this is uncertain. Field 1281 is also of uncertain location, as there is no cross-index to its location.

Several bags of fragmentary armour scales have also been found in the suburban houses of Nuzi. Although they are unprovenienced, and are from no noted stratum, they are of similar form and style to the other scales found at the site, and so are here said to date from the same time period. Within these bags of fragments, 5 partial scales could be reconstructed in the short amount of time available for the examination of the finds, and more could likely be reconstructed given sufficient time. The armour scales at Nuzi have been dated to c. 1475 - 1450 BC, and are here assigned to Date Code 4.

4.4.13) Pi-Ramesse / Qantir

Nine armour scales were found at Pi-Ramesse in a Workshop context in Stratum B/2 and date to c. 1330-1245 BC (Date Code 2). They were found with a variety of other metal-working tools and other items generally associated with the military (i.e. stone shield moulds) (Pusch 1993: 133-137, 1990: 113). It is most likely that the scales were produced in this workshop for use by the nearby chariotry garrison (Herold 1998: 135, see also Bietak 1981). Several of the armour scales at Pi-Ramesse are unique as they are made materials other than bronze. Two of the scales, both fragmentary, are made of glazed ceramic, with a further two scales being made of bone and one possibly made of ivory. The remaining four scales are all of copper alloy. This suggests that there was some experimentation with alternate materials. Whether this was in an attempt to reduce the weight or cost of the armour or simply to provide a more visually attractive coat of armour (for conspicuous consumption) is unknown.

4.4.14) Tel el-ʿAjjul

A total of seven armour scales were found at Tel el-ʿAjjul. Three armour scales were found in an unknown context in Area KB in the buildings south of the palace, the function of which is not known. A fourth scale was found in Area KK approximately 35m directly south west of Area KB. The exact strata in which these scales were found is not known, but they may be from Stratum III. They were found in the surface earth above the tops of the excavated walls. They were tentatively dated as "Later than the XIIth dynasty, probably XVIIIth Dynasty" by Petrie (1933: 9), however the stratum has later been dated to 1570-1440 BC, and probably to the reign of Thutmosis III/Hatshepsut (c. 1504-1450) (Stern 1993: 49-53) and therefore have here been assigned Date Code 4.

Three more scales were found at Tel el-ʿAjjul in Stratum IV in the upper part of area J in an unknown context. As such, they date to approximately the 14th century BC (Stern 1993: 53) and therefore are placed in Date Code 3. Area J was above the wadi on the downward slope at the west end of the excavated area on the southern edge of the tell, and above the wadi. Area J is the downward slope at the west end of the excavated area.

4.4.15) Tell el-Fakhar

A large quantity of armour scales were found in two rooms in the "Green Palace" in Stratum II (c. 1450 BC [Date Code 4]) at Tell el-Fakhar (located 35km South West of Nuzi). Only two scales were presented in the publication along with a note that there was a large, but unspecified, quantity of others (Mahmoud 1970: 122). The armour scales were primarily found in association with the 9 skeletons in Room 13 and the 22 skeletons in Room 9. The scales originally were in coats of armour belonging to the soldiers defending the palace. These soldiers perished in the defence of the palace, as the skeletons were piled on top of one another in heaps, and there was evidence of the palace having been burned as large amounts of ash and baked bricks lying over the skeletons (Mahmoud 1970: 118). The doorways appear to have been blocked in an attempt to defend the palace but yet provide a portal through which to shoot arrows. The bodies were also associated with spearheads and numerous arrowheads. Numerous items are very similar to those from the site of Nuzi, and it is thought that the destruction of Tell al-Fakhar is the result of the same Assyrian invasion that was responsible for the destruction of Nuzi

(Mahmoud 1970: 111, 118). It is unfortunate that this collection of armour scales has not been examined in more detail as it appears to be one of the only completely undisturbed contexts in which Late Bronze Age Eastern Mediterranean scale armour has been found. If there was an insufficient number of armour scales for the construction of one single coat, or more than enough for the construction of one, but not two coats, this then would be further proof of the existence and use of composite coats of armour. With the brief examination that has been made, it shows that the coats of armour were, at least on this one occasion, used by active military troops.

4.4.16) Tell Deir ʿAlla

A total of up to 18 armour scales may have been found in Phase E at Tell DeirʿAlla and date to c. 1200 BC. Although there may be up to 18 scales, only 16 of these are here presented in the database, as little evidence exists to determine the precise number found. Twelve scales (6 complete, 2 nearly complete, and 4 fragmentary) were found in the Trench loci/Deposit #620 in area named "slope" (Trench D600). Three fragmentary scales and one complete scales were also found in Trench loci/Deposit #D621. Given the variety of finds (and the large number of luxury goods and ceramic types found), this section of the site of Tell Deir'Alla is interpreted as a sanctuary. It is suggested by Franken (1992: 166) that this Late Bronze Age temple complex had originally arisen as a result of the restored and secured 18th Dynasty Egyptian trade system with Northern Transjordan, and the need for a trade sanctuary. Franken (1961: 365-366) notes that it not possible to determine precisely to whom the armour originally belonged (i.e. Egyptian, Hurrian, or Philistine). It is suggested (Franken 1964: 420) that the armour may have been a dedication in the Temple/Sanctuary in which it was found, or possibly the trappings of a wooden statue, long since decayed. It is suggested by Franken (1992, 1969, 1961) that the Late Bronze Age sanctuary was destroyed by an earthquake, and the subsequent fire, some time just after 1200 BC, so the armour scales from Tell DeirʿAlla are assigned here to Date Code 1.

4.4.17) Tell el-Faraʿh South

One scale was found in a burial context at Tell el-Faraʿh South. The scale was found in burial #206 in Cemetery 200 which is on the plain to the north of the tell. This tomb was one of a large group of wealthy tombs, and was stone lined and covered by large limestone slabs. Tufnell (1930: 11-13) mentions that nearly all the tombs had been robbed in antiquity, but makes no specific mention that tomb #206 had been robbed. Although burial #206 dates to the Iron Age II period (Stern 1993: 441-445), the armour scale is clearly of a transitional Late Bronze/Iron Age style and is similar to database entries catalogue entries *Megiddo 96/F/AR1* to *Megiddo 96/F/AR3* and has therefore been assigned to Date Code 1. Some of the larger tombs had been opened at least once after the initial interment (i.e. Tomb 201 contained the remains of 116 adults and 6 children), so the armour scale may not be contemporary with the other artefacts found in proximity to it. There is no mention in the literature (Petrie 1930) of the number of individuals buried in tomb #206.

4.4.18) Troy

Three armour scales were found on the floor of Building VI F at Troy in a late subphase of Stratum VI. The scales were initially mistaken for "bronze spatulae" or scrapers with the lacing holes thought to have served as rivet holes to attach the scales to a wooden haft (Blegen 1953: 297). These artefacts are, without question, armour scales. There is no suggestion as to the use of Building VI F where the armour was found, however Blegen (1953: 3,6) suggests that Troy VI (and Troy in as a city in general) was a wealthier, high-status acropolis with the general populace living outside of the main city. As the central mound was razed in the Hellenistic or Roman period (Troy IX) for the construction of a temple to Athena, much of the Level VI city was not present for examination during excavation. This further supports the hypothesis that scale armour was associated primarily with the elite (see Chapter 5.1.2). The site has been dated to c. 1425-1275 BC, and has here been assigned to Date Code 3.

4.4.19) The Tomb of Tutʿankhamūn

A selection of 14 armour scales from TutʿAnkhamūn's armour are presented in the database. Given the restraints on time and the exceptionally delicate state of the remains of this coat of armour, it was not possible to make individual measurements on each scale. As such, a selection of 14 armour scales were taken from the tray of loose scales (see Chapter 2.3.3.3) to represent the various sizes and lacing patterns found in the coat of armour.

It is not certain that the rawhide scale corslet was in its original location within the tomb upon excavation, as the tomb had been broken into shortly after TutʿAnkhamūn was interred.

Priests are thought to have restored order to the objects in the tomb after minor looting had taken place. It appears that the tomb had been quickly rearranged with many objects having been replaced in positions different from the initial deposition. Within the subcontext of the box in which the armour was found, there was also a faience thet-amulet, a violet glass ded-amulet, and a pair of plaited grass sandals. Given the fact that the armour appeared to have been hastily bunched up and literally stuffed into a box when the priests tidied up the tomb, it is uncertain whether the amulets and sandals were originally associated with the armour or not.

Upon clearing the tomb, Howard Carter removed the box and its contents for analysis, and at some time between then and the present day, slightly more than half of the armour has gone missing and what remains is now in considerably worse shape than it was in the 1920's (Based on Burton's original photo; Fig. 34). The state of the armour now defies a thorough investigation and reconstruction of the original overall structure. Carter (1933: 143) states that the armour was too decayed for preservation, although some attempt at conservation was made as evidenced by the note in the Griffith Institute TutʿAnkhamūn artefacts card catalogue of solutions used in conservation. Much of the armour had, in antiquity, fused into a melted, blackened mass which is a product of the decay of the biologically active rawhide. Not much of this fused mass remains, as it has likely been discarded. It must be noted that the association of this particular coat of armour with such a broad range of artefacts is unique to Egypt and is also unique to the entire Eastern Mediterranean, and as such should not be taken to represent a typical burial-style in which armour is found.

4.4.20) Ugarit

A total of at least 56 armour scales have been found in a variety of contexts at Ugarit, and date to two distinct periods. Difficulties have arisen in determining where within the site many of these scales were found due to the poor recording of the excavations. At least four armour scales were found in association with numerous arrowheads, a stone female statuette, an ivory hippopotamus staff (or insignia) finial, and fragments of gold leaf from the veneer of a piece of furniture or figurine. The scales are not attributed to a specific Stratum, but were found in the entrance to the archives of the palace. As such, they are here assigned the context of Public Building. These scales were deposited during the destruction and firing of the palace (Schaeffer

1951: 12), c. 1186 BC, and therefore is placed in Date Code 1. Unfortunately, there is no specific mention of the numbers of armour scales found in this context, but they nonetheless are associated with the palace in some way.

Two armour scales were found in a residential area in the extreme North-West of the site in Stratum III or IV. Schaeffer (1938: 315-316) believes that they were deposited at the time of the destruction and firing of that residence, c. 1300-1200 BC, and also notes that he is uncertain whether the armour belonged to the attackers or to the defenders. These armour scales, if they date to the destruction of the city, date to c. 1186 BC, and have therefore been assigned to Date Code 1.

Four distinct armour finds were made in Courtyard V close to a large sunken basin. Although these have been placed into a context called "Courtyard", it must be noted here that this refers to a courtyard within a building, and not an open space outside of or between buildings. These armour scales may have been deposited during the looting of the palace rather than deposited during a battle. One scale was found South-West of the basin at a depth of 3.50 metres, and another was found at the corner of an oven or furnace to the south of the Basin at an unknown depth. Two large finds of armour scales were also found amongst large groups of stones in proximity with the basin; one group of 20 scales was found at a depth of 3.40 metres, and another group of 22 scales was found at a depth of 2.60 metres. Finally, two armour scales were found in the collapse of the building adjacent to the Southern side of the palace at a depth of 1.20 metres. All of these scales are attributed by Schaeffer (1962) to Stratum 4 (based on North's 1974 re-analysis of the stratigraphy) and therefore date to c. 1450-1365 BC. Since these scales are from varied depths in the strata, and even though Schaeffer's strata are difficult to interpret and the scales may have been deposited during the destruction of the city (C. 1186 BC), they have been placed in Date Code 3 based on Schaeffer's dating. It is also possible, although impossible to prove, that the scales themselves may date to c. 1450-1365 BC as Schaeffer states, but were only later deposited where they were found during the looting of the city (c. 1186 BC).

Four more armour scales were found in areas in, or near to, various archive rooms in the palace. One scale was found at an uncertain depth and an uncertain location in either the corridor of Room 53 or Room 52 of the East Archives. Another 2 scales were found in the area of the corridor and steps of Room 69 in the South Archives at a depth of 3.40 metres. One armour scale was found in the East archives in the corridor of Room 53 at a depth of 2.80m. These scales were all found in Stratum 4 (Schaeffer's Stratum SC10), and date to c. 1475-1450 BC (Date Code 3). These scales have been here given the context type Public Building.

4.5) Discussion of the Context Types

There are a few armour scales presented in the database which have been assigned to two context-types. This has been done when the armour has been found in a context of uncertain type, i.e. entry *Beth Shan 27.10.915* where the scale has been found in either a Courtyard or Domestic Unit context. This is only done where there is the possibility of more than one interpretation of the context. In cases where armour has been found in a context which is totally unidentifiable, or entirely lacks provenience, a context type of "Unknown" has been assigned.

4.5.1) Public Building

The context type presented in this database as "Public Building" must be described. The term "Public Building" here includes palaces and all other buildings in which the public could be expected. This does not denote the lower and lowest class individuals, but those of higher classes who would routinely have access to elite buildings as serving staff or the elites/nobility themselves. Armour scales could have as easily been deposited by soldiers (who often lived in areas of the palace at (i.e.) Nuzi, see Kendall 1974: 84) as by the nobility themselves. Chapter 5 notes that the soldiers and charioteers who were in receipt of armour were of markedly higher status than the infantry soldiers, and their presence in elite establishments was almost certainly not uncommon. No armour scales have been found in areas of a palace complex which can be identified as a barracks or as areas specifically associated with soldiers, however, these areas would be prime locations for looting, as they would have been well known and almost certain to have contained some weaponry and other items. A total of 86 armour scales have been found in contexts termed "Public Building".

4.5.2) Temple/Sanctuary

The context here termed "Temple/Sanctuary" is defined as a context definitely defined as having been used in ritual or religious aspects. This assignation of armour scales to this context within the database is based upon the original excavation reports: If the armour scales are noted as having been found in a temple or sanctuary context by the excavators, they are noted as such in the database. The presence of armour scales in a Temple/Sanctuary context may indicate that the armour was intentionally placed in the context as an offering, such as suggested by Franken (1964: 420) for the armour from Tell Deirʿ Alla. There is a possibility, however, that the armour scales could have arrived at their final location in the site through military events. It is possible that one or two armour scales could become detached from a coat of armour during battle, but the presence of an entire coat, or the majority of one, would more likely indicate a dedicatory offering. A dedicatory offering might also be noted by armour scales found next to the walls as though they had been placed there as a offering. It might also be worthwhile to examine any storage rooms associated with Temple/Sanctuary contexts in the future to determine if dedicated armour had been placed in storage. There are a total of 55 armour scales in a Temple/Sanctuary context presented in the database.

4.5.3) Domestic Unit

The context type "Domestic Unit" is defined here as a residential unit and the rooms with within it. The majority of the armour scales in this type of context come from the elite houses at Nuzi. The Nuzi texts also note that some elite soldiers kept their palace-issued armour as a personal possession, and it is not unreasonable to assume that some of the highest ranking individuals also may have owned their own armour, i.e. Prince Šilwitešup, in whose house were found a considerable number of armour scales. As with armour scales found in other archaeological contexts, there is often a lack of information on the specific buildings in which they were found. In a similar situation to the burials (discussed below, see also Chapter 5.4), the presence of archery equipment in a household armoury/storage context might also indicate that there had once been organic armour present. This does not, however, take into account the presence of archery equipment for hunting and sport. A total of 81 armour scales were found in a Domestic Unit context.

4.5.4) *Courtyard*

The context labelled "Context" is based upon the excavator's identification of the area in which the armour scale was found. All but one scale in this category was found at the site of Ugarit. The courtyard in Ugarit where these scales were found was part of the palace complex, and a number of possible taphonomic processes exist. It is possible that the deposition of some of the armour scales at Ugarit was the result of military action, however, it is also possible that the armour scales were deposited during looting of the palace as the courtyard in which they were found (Courtyard V) is entirely enclosed within the building, and not an area between or outside of other buildings. The deposition of single or perhaps two armour scales in a given locus have occurred during an action as simple as training. The lacing and stitching which hold the scales both together and to the backing material could wear and break, eventually resulting in the loss of a scale or two. The larger groups of scales found in Courtyard V (packages of 20 and 22 scales, see above) are unlikely the result of military training. Such large groups of scales belonging to a costly coat of armour would be unlikely to remain lying where dropped as they could easily have been returned to the craftsmen or palace armouries to be recycled. Should they have been deposited by some manner in battle, they are more likely to have gone unnoticed, particularly if there was considerable destruction debris obscuring the remains.

The protection afforded by a coat of armour would, generally, protect the life of the user. As most of the soldiers making use of armour would have been of elite status, perhaps even nobility, they would be less likely to be mortally injured. Should one of them have died in battle, the body would be more likely to be retrieved, and with it the coat of armour, thus making the deposition of entire coats of armour in a battle situation unlikely. One example where the deposition of an entire coat of armour, or perhaps several, did occur was at Tel al-Fakhar (noted above) where the soldiers were trapped in the collapse of the building they were defending.

4.5.5) *Workshop*

This context is defined by the presence of tools and other equipment associated with the production of artefacts. The only scales in the database which are placed in this category are those found at the site of Pi-Ramesse. These scales were found in association with tools, a stone shield mould, and a small selection of arrowheads. The presence of two fragmentary ceramic armour scales as well as two armour scales made of bone (and a third scale, possibly in ivory) suggest that there was a degree of experimentation being undertaken at some stage in the production of armour scales at this locale. The repair of a coat of armour may have occurred at many areas, i.e. the palace armouries, on campaign, at a soldier's home, etc., however the manufacture of armour scales in experimental materials would have been most likely conducted in an area in which armour scales were already being produced. The fragmentary nature of the ceramic, bone, and ivory scales suggests that they may have been damaged during manufacture and were therefore discarded. The ceramic armour scales, like organic scales, would not be suitable for recycling if damaged. A total of 9 armour scales were found in a Workshop context.

4.5.6) Burial

All the armour scales associated directly with an intentional burial are placed in this category. This context does not include sites such as Tell al-Fakhar, as the skeletons with whom the armour scales were found were buried within the room of the palace which they were defending, and therefore were not part of an intentional burial. The examination of the artefacts associated with the armour scales in burials may provide some indication as to the status of the interred individual or individuals. The possibility of the existence of Late Bronze Age warrior burials, a concept previously thought to have been abandoned at the end of the Middle Bronze Age (see Philip 1995, 1989) may be discerned from the inclusion of arrowheads, which form the only non-organic aspect of the typical high-status soldier's burial equipment (see Chapter 5.2). Within the database there are a total of 201 armour scales associated with burials, the majority coming from Kāmid el-Lōz (182 scales) and the tomb of TutʿAnkhamūn (14 scales representing the remains of the whole armour).

4.5.7) Rubbish Deposit

No armour scales were found in a context which could be distinguished as having been a rubbish deposit. This suggests that there was no intentional disposal of metallic armour scales. As organic armour scales (i.e. rawhide or leather) would be unlikely to survive in a rubbish deposit context, there is no information available to assess whether or not they were intentionally discarded, but they probably would have been if they were too badly damaged to be incorporated into another coat. Bronze scales, if badly damaged, could easily be recycled.

4.6) Analysis of the Data

Forms, Tables, and Queries have been produced within the Microsoft Access database program and manually queried to establish patterns of associations and relationships of the armour scales with the various aspects presented below. The data has been manually converted into graphs using the *Corel Draw!* graphics software. It must be noted here that the sample size is all-important in the assessment of this data, as armour scales are found singly or in very small groups at some sites while at others large groups have been found. For instance, the armour find at Kāmid el-Lōz (see Chapter 2.3.1) is the largest published collection of armour scales known, and therefore forms a large portion of the database. Although future finds of scale armour may drastically change the information presented here, the interpretations are offered up with full recognition that the sample size is very small. The following data analysis, and the associated graphs, are primarily based on complete scales. Damaged and broken scales, e.g. those missing edges which prevent both making accurate measurements and definite recognition of the lacing pattern, are usually not included in the creation of the graphs discussed below, however in cases where lacing pattern and measurement are not necessary, such as in the examination of the number of armour scales found in particular types of contexts.

4.6.1) Length-to-Width and Surface Area Relationships

To establish a numeric figure for the sizes of each of the complete armour scales the upper-width of each scale has been multiplied by the length. This calculation gives the area of a rectangle of these measurements which is not an entirely accurate reflection of the total surface area of the armour scales (as the lower edge is usually rounded or pointed in shape), but it does present a fair estimate. As noted above, the width is sometimes greater in the lower half of the scale than it is the upper half, but the difference is rarely greater than 2 or 3 millimetres. This process of achieving a numeric figure for the "size" of the scale has not been done to suggest the actual size of the armour scales, but to provide a relative framework within which to conduct the analysis. Calculating the specific surface area for each armour scale would have been a prohibitive task given the large number of scales involved and the often complex shape of the individual scales. The slightly greater numbers given as the size of the armour scales does not affect the analysis of the data, as this number is used in no mathematical calculations. The form used for the calculation of these figures is presented in the database as Form "ScaleSurfaceArea".

4.6.1.1) Overall Length-to-Width Ratio

For this analysis the upper and lower widths of the armour scales have been averaged for a single measurement. In cases where the upper and lower widths on an individual scale are not equal, the difference is usually no more than 2 or 3 millimetres. Figure 74 shows the Length-to-Width ratio of all the complete scales in the database excluding the unperforated scales from Nuzi. The analysis of the perforated scales shows that there is a relationship in which the length of the armour scale is approximately 2.5 times greater than the width, which implies that there may have been a concept of a "correct shape" for the armour scales which was perhaps based on both appearance and function. This trend suggests some standardisation of the length-to-width ratio of armour scales which may have occurred in experimental stages of armour production, probably in organic materials, before proceeding to manufacture more costly coats of bronze scale armour.

The length-to-width ratio is most likely a factor in the degree of protection that a coat of scale armour would provide, as it would determine the flexibility of the armour. Smaller armour scales would decrease protection against blunt trauma while increasing flexibility, while larger scales would have the opposite effect. The structure of a coat of scale armour, as described in Chapters 2 and 3, shows that greater flexibility of the armour is necessary in the X-axis (encircling the body) than is necessary in the Y-axis (in line with the body). Greater flexibility in a coat of armour could be achieved through the use of square armour scales, but at a decrease in protection and an increase in the amount of time needed to manufacture the armour. The length-to-width ratio of organic armour, and the overall size of the scales, may have been different, but with only the armour from TutʿAnkhamūn's tomb as an example, there is insufficient data upon which to base further hypotheses. There also must be room on the armour scale to place the required lacing holes, while leaving a sufficient amount of unperforated space which will cover the lacing in the scale beneath (see Chapters 2.3 and 3.3 on the structure of the armour). Finally, as Ventzke (1986:179) notes, there are places in the armour where there are four thicknesses of armour scales (where the scales overlap side-to-side and upper-over-lower edges, and others where there is only overlap side-to-side. The longer the armour scales, the greater amount of area is protected by only two scales, which in bronze is adequate protection against even close-range archery (see Chapter 3.3 and 3.4), and would reduce the overall weight.

4.6.1.2) Site Specific Length-to-Width and Surface Area Ratios

The length-to-width ratios and the overall surface area of the armour scales from all of the sites where undamaged armour scales have been found are presented in Fig. 74. Within each of the larger groups of scales (Kāmid el-Lōz, Tutʿ Ankhamūn, Boğazköy, Nuzi and Ugarit) it is apparent in that there are two or possibly three distinct "sizes" of armour scales. This was apparent upon examination of the coat of armour found in the tomb of Tutʿ Ankhamūn, and is also in the armour from Kāmid el-Lōz. This corroborates the distinction made between large and small scales in the Nuzi military texts (see Chapter 2.3.2), and is most likely a structural feature rather than one which was based on status. Smaller scales, as noted in Chapter 2, were used where increased flexibility was necessary in a coat of armour, particularly across the shoulders. Ventzke (1983: 169) notes this and suggested that the smaller scales were fashioned into a mantle which covered the shoulders (Fig. 24). There is also the possibility of a third intermediary size of scales, but these scales may have simply come from a coat of armour made to slightly different specifications. The general size of the armour scales may also reflect the relative degree of status associated with a particular coat of armour; the smaller the scales, the greater the status, due to the increased amount of work necessary during production (see Chapter 5.3). It is not unlikely that different workshops produced armour to slightly different specifications, hence the moderate variation in size from site to site shown in Fig. 74. Some of the largest scales shown in Fig. 74 may actually be from coats of scale armour used to protect the chariot horses, a military item which is also noted in many of the Nuzi military texts. The distinction is not easy to make, as the larger scales could easily form the body of a coat of human armour, albeit a coat with reduced flexibility. The overall variation in the size of the armour scales between sites is presented in Fig. 75.

4.6.1.3) Context Specific Length-to-Width Ratios

The length-to-width ratios for the armour scales grouped by the contexts in which they have been found are presented in Fig. 76. The range in size of the armour scales do not appear to have any correlation to the contexts in which they have been found. The smallest scales presented in the graph are from the coat of armour from the tomb of Tutʿankhamūn, with the some of "above average" size also coming from a Burial context. The larger scales, again possibly from a coat of horse armour, come predominantly from Public Building or Domestic Unit contexts, and are not represented in the other types of contexts. This may suggest that horse armour was not an item placed in burials or dedicated in temples, however the sample size allows no further hypotheses.

4.6.1.4) Size vs. Date Relationship

Figure 77 suggests that the greatest variation in the size of armour scales was during the period here termed Date Code 3 (1430-1320 BC). This may indicate the wider usage of scale armour technology and increased experimentation in scale sizes during this period, or it may simply reflect the fact that the largest number of armour scales comes from this period. It also suggests that the same technology, more-or-less, was used throughout the Late Bronze Age. The sample size restricts the hypotheses which may be made with regards to the overall size of the armour scales within specific time periods. Date Code 1 (1210-1100 BC) does appear to show that the average size of armour scales were becoming larger again after a drop in overall size in Date Code 2, however, this may also be due to the number of scales found in Date Code 2 (44 scales) versus Date Code 1 (94 scales). The generally decreasing size of scales, excepting those from Date Code 2, may reflect an increase in the use of metallic armour made of smaller scales on the part of the wealthy due to the increased status achieved due to increased workmanship. There is no information, however, on the size of the armour scales in the organic coats of armour which were issued to the active highly trained "commando" soldiers (discussed further in Chapter 5.1.2).

4.6.2) The Lacing Patterns

Within the database, lacing pattern codes IR (irregular), BR (broken), and U (unknown) have been assigned when the lacing pattern is not known or does not conform to a regular pattern. Lacing Pattern 0 (zero) has been assigned to armour scales which are unperforated.

There are a total of 473 (94.6%) perforated scales included within the database, with the remaining 27 unperforated scales all coming from Nuzi (i.e. database entry *Nuzi 1930 76.32*). Figure 78 shows the numbers of scales present for each of the lacing patterns. The largest number of scales of a given lacing pattern is Lacing Pattern 5, however 141 of the 142 scales of this lacing pattern are from the armour from Kāmid el-Lōz. All of the scales of Lacing Pattern 22 are from

Boğazköy, however a mirror-image scale of Lacing Pattern 21 has been found at Pi-Ramesse. The most widely distributed lacing pattern is Lacing Pattern 8, which has been found at eight of the twenty sites, covering the entire North to South extent of the armour scale finds (Mycenae to Malqata). Lacing Pattern 7 is the second most widely distributed type, having been found in five sites, which is predictable, as it is a mirror-image of Lacing Pattern 8. Because Lacing Patterns 7 is a mirror-images of Lacing Pattern 8, scales of this type may well have originally been present in some form in all of the sites at which scales of Lacing Pattern 8 have been found.

Most of the Lacing Patterns depicted in Fig. 72 are represented, with types 3 to 17 having been found in at least one archaeological site within the Eastern Mediterranean, which further strengthens the hypothesis that several types of scales were used in the manufacture of a single coat of scale armour. Given the range of lacing patterns identified in the armour from Tut'Ankhamūn's tomb, Boğazköy, Ugarit, Nuzi, and Kāmid el-Lōz it is certain that a broad variety of lacing patterns were employed in the construction of coats of scale armour, showing a wide-spread basis in scale armour technology which transcended the Late Bronze Age Near Eastern political boundaries.

4.6.2.1) Lacing Patterns vs. Size

Figure 79 shows the variety of sizes of armour scales for the lacing patterns for which there are at least two examples of different sizes. As with Fig. 77 there is no distinct correlation between size and lacing pattern. As noted above, the relatively small sample size is further affected by the fact that the majority of the armour scales (83.2 %) are from four sites (Kāmid el-Lōz, Boğazköy, Ugarit, and Nuzi).

Aside from the scales of indeterminate lacing pattern, the largest of which may actually be horse armour (*Tel el-'Ajjul III KB-1140*, the Malqata scales, *Nuzi 1930.76.8*, and the 36 *Nuzi Corslet* scales), the most widely distributed scale type (Lacing Pattern 8, see above) also shows the widest range of sizes. There is no information available to suggest why such a range of sizes exists, however it may possibly be linked to conspicuous consumption, or simply that size differed slightly between individual sites or local workshops. The smaller the scales, the greater the labour involved in manufacturing the armour will be, and hence a greater degree of status may be conferred upon the owner or wearer of the armour . Alternately, the wide range of sizes may indicate experimentation on behalf of the craftsmen in deriving the "best" size of scales for a balance between protection and mobility.

4.6.2.2) Lacing Pattern vs. Date

Figure 80 compares the lacing pattern numbers against the date codes (see Fig 73). There appears to be a correlation between the number of different lacing patterns and the Date Code, with Date Code 3 specifically showing the widest range of scale types. This is, however, due to the fact that the majority of the scales in the database come from 4 sites, two of which (Kāmid el-Lōz and Tut'Ankhamūn's tomb) being complete or mostly complete coats of armour deposited in burials. As several types of armour scales must be used in the construction of a coat of scale armour, this correlation is not applicable to armour scale finds in general. Should a broader selection of armour scales be found in future excavations, particularly whole or mostly complete coats, this trend will almost certainly also appear in Date Codes 1, 2, and 4. It is also probable that each lacing pattern would have been gradually introduced in the initial stages of the experimentation with the concept of scale armour, although it is not possible to determine the order in which they were introduced.

4.6.3) Contexts

As described above, each of the armour scales is assigned to the context in which it was found. In most cases the context type, as allocated by the excavator, to the loci in which the armour scales were found has been used. In the few cases where the armour is from an indistinct, but not entirely unknown, context they are assigned to either a double entry in the two most likely context types. When the scale is from a completely unknown context, or is unprovenienced, it is placed into the category entitled "Unknown". Within the *Context* form in the database, the different contexts are entered with the use of a tick-box.

4.6.3.1) Contexts vs. Sites

The relationship between the sites and the contexts in which armour scales have been found is presented in Fig. 81. As shall be discussed in the following chapter, armour has been found mainly at major imperial capitals and smaller sites which have regional importance. No armour scales have yet been found at small rural village-type settlements. It must be noted that armour, primarily if not strictly a military item, would be associated with soldiers of higher or elite status. Anywhere that these soldiers could be found is a potential context for single or small numbers of armour scales to be deposited. Any place in which an elite chariot soldier could be found, alive or dead, is a potential place for scale armour to be found. Battle, conspicuous consumption during burial, religious offerings and temple dedications, and the manufacture of the armour itself, are all situations which may result in the deposition of one or more armour scales. Intentional deposition of complete coats of armour was most likely to have occurred in burials and in situations where armour was put into storage. The Nuzi military texts show that coats of armour were kept by some of the elite soldiers as a "personal possession" (see Chapters 2.2.1.8 and 5.1.1), which makes it certain that there was the *potential* for entire coats of armour to have been deposited in Domestic Units. Such an archaeological find would be contingent upon the specific context having remained undisturbed until the modern day. The only situation where scale armour was intentionally and permanently taken out of circulation, was when it was included in elite burials.

As such, burials provide the only environment in which a complete coat of armour is likely to be found, and it is in this context type that the largest groups of armour scales have been found. Although there are no undisturbed burials in which armour scales have been found, Tutʿankhamūn's tomb did contain a complete coat of scale armour, but unfortunately it is no longer intact, nor is it complete (see Chapter 2.3.3). The difficulty in assessing the overall form of scale armour and determining the total number of necessary scales is due to the disturbed contexts, and particularly in the case of Tutʿankhamūn's armour, the relatively poor state of preservation. The principles governing the use and eventual deposition of scale armour are discussed in more detail in Chapter 5.

4.6.3.2) The Contexts and Numbers of Armour Scales Found Therein

Figure 81 shows the numbers of armour scales found in each of the contexts in the database. The largest numbers of scales were found in Burial contexts (201 scales – 40.2%), but it must be noted that the majority were found at the site of Kāmid el-Lōz in one deposit (182 scales = 36.4% of total). Should all the individual armour scales from Tutʿankhamūn's armour have been available for study and added to the database, this number would be considerably higher, further skewing the analysis.

The next largest number of scales, by context, have been found in Public Building contexts (86 scales = 17.2 %), the definition of which has been discussed above. In order, the remaining armour scales have been found in the contexts Domestic Unit (83 scales = 16.6 %), Temple/Sanctuary (55 scales = 11.0 %), Courtyard [see definition above] (47 scales = 9.4%) and Unknown (25 scales = 5.0%), and Workshop (9 scales = 1.8%). This totals 101.2% which takes into account the 6 armour scales which come from double contexts, as described above (entries *Beth Shan 27.10.915*, *Ugarit 1257.1* and *1571.1*, and *Megiddo 96/F/AR 1/3, 96/F/AR 2/3,* and *96/F/AR 3/3*).

It would be likely that an individual would pick up an armour scale that had been deposited unintentionally, such as in a courtyard where a scale might have fallen from a worn coat of armour. It is especially unlikely that a large deposit of armour unintentionally deposited in a public, or relatively public, place (such as at Ugarit (see above) where a considerable quantity of armour was found in a courtyard) would not be retrieved. One hypothesis which might account for the clusters of armour scales found in the courtyard at Ugarit is that a piece of armour was thrown off in battle, such as is described in the Nuzi military texts (see Chapters 2.2.1.6 and 5.3.1). Another might be that during the looting or the site some artefacts were dropped in transit or hidden for later reclamation. Armour found in a Domestic Unit or a Temple/Sanctuary would be more likely to have remained where it was initially deposited, as the taphonomic process involved could have been either "deposition as storage" or "deposition as dedication".

No armour was found in Rubbish Deposits, which suggests that metallic scale armour was not intentionally disposed of when damaged. Broken or damaged scales could easily be remelted, and thus recycled, while undamaged scales from a ruined coat could be saved for repairing another coat or fashioned, along with other scales, into a new coat of armour. A total of only 9 armour scales were found in a Workshop deposit, which suggests that there either few armour-producing workshops have been found, or that there were few armour scales which were lost during manufacture. Similar to the lack of armour scales in Rubbish deposits, scales which were damaged during production would have been recycled, probably along with scales from coats which were damaged during use, as it is most likely that many of the damaged coats of armour would have been taken back to the workshops for repairs. Due to the level of decay present in most Middle Eastern archaeological sites, it is quite unlikely for organic artefacts such as a leather armour scales to survive. Once an organic armour scale was damaged beyond use, it would have virtually no recyclable value.

Burials, Domestic Units, Public Buildings, Temples, and Workshops are all contexts which would be likely targets for looting after (or even before) the given site was deserted. A high status burial which was known to have included metallic and other high-status goods would probably remain in public knowledge for some considerable time after the interment, and therefore present a tempting target for looting after the downfall of any authoritarian body. This hypothetical situation does not, of course, take into account such factors as contemporary personal religious belief, superstition, etc., however it may be one possible explanation for the general lack of artefacts from high status contexts, and thereby be one reason for the relative lack of metallic military equipment such as armour scales.

4.6.3.3) Contexts vs. Date

Figure 82 shows the relationships between the ages of the armour finds and the contexts. The manner in which armour was used (as an item of military equipment) by the soldiers would probably have remained mostly unchanged as long as the methods of warfare did not change. The social aspects could, however, have changed considerably. Armour scales do not appear in Temple/Sanctuary contexts until approximately 1430 BC (the beginning of Date Code 3), which may suggest a change in contemporary perception of scale armour. Given that the armour was an item associated with the elite, and given the great expense in manufacture, it is probable that little armour was in use on the battlefield at any time, and certainly less in the earlier phases of the Late Bronze Age than in the later phases. It is hypothesised here that the association of armour with the highly trained elite warriors (see Chapter 5.1.2) gradually became more concrete, and therefore may have made a coat of armour seized in battle an acceptable item for dedication in a temple. Furthermore, the increase in the numbers of armour scales from Public Buildings at the end of the Late Bronze Age may suggest deposition occurred during battle, however, there is also little concrete evidence for this.

These hypotheses are very tentative given the small sample size. There do not appear to be any *strong* correlations between the context and the date, but these possibilities do exist. With a larger sample size, more definite trends may begin to appear. The use of the armour as a status symbol probably changed throughout the time period of the Late Bronze Age and would likely have also varied somewhat with geographic location. One correlation which does seems fairly strong is that at no time do armour scales appear in Rubbish Deposits, suggesting that their relative value remained high throughout the Late Bronze Age.

4.6.3.4) Contexts vs. Lacing Patterns

The relative numbers of scales of each lacing pattern found in particular contexts are portrayed in Fig. 83. Again, Lacing Patterns 4 and 5 are most prominent, coming mostly from Kāmid el-Lōz. The majority of the armour scales are from a Burial context, however it must be noted here that it is from this type of context that the largest collections of scales have been found (from Kāmid el Lōz and the tomb of TutʿAnkhamūn). The fact that there are very few damaged scales (the *BR*oken lacing patterns) suggests that the coats of armour at Kāmid el-Lōz and in TutʿAnkhamūn's tomb were intentionally placed, and were probably undamaged upon deposition. The broad range of scale types found in Burial contexts shows the wide number of lacing patterns necessary for the construction of a single coat of armour, but this should not necessarily be taken to indicate that there was a distinct difference in the types of lacing patterns used across the Near Eastern Late Bronze Age, as these finds are predominantly from only two archaeological sites.

The relatively high number of damaged scale types from Temple/Sanctuary contexts may suggest that partial coats of armour had been dedicated after having been captured in battle. The majority of the scales found in a Temple/Sanctuary context are from Boğazköy and Tell DeirʿAlla. As with the armour found in Burial contexts, there is not a large enough sample to firmly establish any particular depositional patterns. The large number of scales of Lacing Pattern 22 are from Boğazköy and were found in a single loci in a Public Building context (perhaps as a section or a few rows from a coat of armour), but this does not suggest that there is a correlation between this scale type and this particular site or type of context. The presence of one scale of

Lacing Pattern 21 (a mirror-image of Lacing Pattern 22) was found in the Workshop context at Pi-Ramesse, and shows that this general Lacing Pattern was also in use in Egypt, a goodly distance from Boğazköy.

Due to the relatively small numbers of armour scales found in areas other than the major four finds from Kāmid el-Lōz, Ugarit, Nuzi, and Boğazköy, it is difficult to determine whether there is any link between the lacing pattern and the contexts in which the armour was found. Most likely there are no correlations as several different types of armour scales were used in the manufacture of one coat of scale armour, as has been shown in armour from Tut'Ankhamūn's tomb and by Ventzke (1983) in his work on the armour from Kāmid el-Lōz.

4.6.4) The Associated Artefacts

4.6.4.1) Association of Armour with Specific Artefact Types

An assessment of the association of scale armour with specific artefacts is presented in Fig. 84. The most common artefacts associated with armour scales are arrowheads, other weaponry (excluding arrowheads), figurines, weights, seals, and scarabs. The association of armour scales with elite materials has also been included. Associations have been made with gold, silver, ivory, alabaster, and faience. Each of the groups of artefacts and materials will be discussed in turn.

4.6.4.1.1) Arrowheads and Other Weaponry

Perhaps it is predictable that the artefact most commonly associated with armour scales are arrowheads, given the potential military nature of both. As can be seen in Fig. 84 the numbers of arrowheads found with armour scales is greater than any other artefact save artefacts made of gold at Kāmid el-Lōz, the majority of which are individual beads from a necklace (see Hachmann 1989: 109-110). There is unfortunately no count of the number of arrowheads in the specific contexts for Boğazköy, Pi-Ramesse, or Tell al-Fakhar. The best example, aside from Tut'Ankhamūn's tomb, for the association of arrowheads and weaponry with burial contexts is at Kāmid el-Lōz, where a selection of 28 arrowheads were found along with the armour and a large quantity of gold in an obviously elite burial. This suggests that there may have been an association of archery equipment and body armour in the elite tombs, an association which may have previously been missed due to the organic component of much of the body armour (leather or rawhide armour scales). This topic shall be discussed in greater depth in Chapter 5.

There are few other examples of other types of weaponry found in association with armour scales. Three curved khopesh swords (which were probably prestige items) have been found with scale armour; two from the tomb of Tutʿ Ankhamūn and one from Kāmid el-Lōz. In addition one other (presumably straight) sword was found with some of the armour scales at Ugarit. Daggers have also been found in association with armour at Gezer (stratum V), Kāmid el-Lōz, Pi-Ramesse, and at Lisht. The daggers found at Lisht were inside a sealed bundle of scrap metal along with two armour scales, 5 knives or fragments thereof, and a wide range of other metal implements, most of which were damaged in some manner. Knives have also been found at Nuzi (possible knives and fragments thereof totalling a possible four examples), and a single knife from Tell Deirʿ Alla. Axes are not commonly associated with scale body armour, with a total of only two examples from Ugarit having been found in association with armour. One is a bronze axe in the shape of a hand and another a "Neolithic" stone axe (Schaeffer 1962: 117), both perhaps items of value.

Spearheads are also occasionally, but rarely, found in association with armour scales. They have been found with armour at Megiddo (1 example), Nuzi (5 examples plus 1 indeterminate spear/pike-head), Lisht (1 socketed example), and numerous uncounted examples from Tell al-Fakhar. Another example, cited as a javelin head, has been found at Ugarit. The distinction between what is an arrowhead and what is a javelin head might be cleared by further experimental work, however it must be noted that there will likely always be examples of transitional sizes between these categories.

The tomb of Tutʿ Ankhamūn poses a different set of material associated with armour. As Tutʿ Ankhamūn's armour is an anomaly in itself being entirely organic, it may also be an anomaly in its broad association with all of the other artefacts in the tomb. Directly associated with the armour (Carter's artefact #587a [see Murray and Nuttall 1963]) in the wooden box (item #587) were a faience *thet*-amulet (item #587b), a pair of plaited grass sandals (item #587c), and a violet glass *ded*-amulet (item #587d). It is unknown if these artefacts were initially associated with armour at the point of interment or if they were placed together in the wooden box when the priests restored order to the tomb after it had been (lightly) plundered (see Reeves: 1990:95-97). In the opinion of the author, the armour was quickly placed into the box by the priests upon tidying up the tomb, and it is this which lead to the armour being crumpled up and the subsequent relatively poor state of preservation. In any case, the artefacts from Tutʿankhamūn's tomb were specific to burial practices in New Kingdom Egypt, specifically the burial of a king, and cannot therefore be assumed to have many similarities with other regions of the Late Bronze Age Near East.

The rest of the tomb contained a very wide variety of weaponry. Within the tomb were 29 composite bows, 14 wooden self bows and approximately 400 arrows of a variety of types (McLeod 1982: 1). A wide range of fighting sticks, wooden practice swords, clubs, boomerangs, and throw-sticks were found in the tomb along with two khopesh swords and the two famous daggers found inside the sarcophagus (Carter 1933, Murray and Nuttall 1963). In addition to these artefacts were 6 full-sized chariots (Littauer and Crouwel 1985: 96). There are no definitive hypotheses to date to account for the broad range and numbers of military artefacts within the tomb, especially as there is no evidence that Tutʿankhamūn ever took part in a military campaign. It must be noted, however, that military equipment was probably closely associated with royal prestige.

4.6.4.1.2) Gold and Silver

Scale armour is also found with gold and silver artefacts on occasion. As can be seen in Fig. 84, gold and silver is found associated with armour scales at 8 sites. A large number of gold artefacts has been found at Kāmid el-Lōz, however it must be noted that 69 of the 118 objects are individual beads presumably from a single necklace or other item of jewellery. There is unfortunately no count of the gold objects in context with armour scales at Boğazköy, with only the statement "...many artefacts of precious metals" (Neve 1983: 440). At Ugarit the majority of gold artefacts associated with armour scales, where specifically noted or described, are related to jewellery, and a few fragments are thought to be gold appliques from furniture or small caskets (Schaeffer 1962: 95, 97).

The silver found in association with scale armour is again primarily in the form of jewellery. As noted above a bronze sword was found at Ugarit (Ugarit artefact #1303) which had a hilt and guard of silver (Schaeffer 1962: 99, see also Schaeffer 1955). This, aside from the two highly decorated daggers in Tutʿankhamūn's tomb, is the only decorated weaponry found in association with scale armour. One other item, recognized as being made of electrum, is a pin from Troy (Blegen 1953: 297). This artefact has been placed in both the Gold and Silver category in Fig. 84 as electrum is an alloy of these two metals.

4.6.4.1.3) Ivory, Alabaster, Faience, Figurines, Weights, Seals, and Scarabs

Armour scales have also been found in association with other artefacts commonly attributed to the more wealthy individuals in Late Bronze Age society. Ivory appears with armour at four sites (Beth Shan, Boğazköy, Troy, and Ugarit) and possibly a fifth piece, a gaming board, at Kāmid el-Lōz. Alabaster was found in context with armour at Boğazköy, Megiddo, Tell Deirʿ Alla, and Ugarit. Thirty-nine pieces of faience were found in association with armour at Beth Shan, particularly seals, scarabs, and jewellery (primarily beads). A few pieces each were found at Megiddo, Ugarit, and Tell Deirʿ Alla.

Weights made of a variety of materials and in a variety of shapes and sizes have been found at Beth Shan, Boğazköy, Megiddo, Nuzi, Tell Deirʿ Alla and Ugarit. The broadest range come from Ugarit with 14 examples in bronze, lead, and a variety of types of stone. Figurines are also quite commonly associated with armour at Beth Shan, Boğazköy, Megiddo, Nuzi, Tell el-Faraʿh South, and Ugarit. They are predominantly of anthropoid form however zoomorphic forms were found at Tell el-Faraʿh South (a cat figurine and a Bast figurine), Nuzi (a large stone ram's head), and Beth Shan (the torso from a cobra figurine). The figures are made from a variety of types of stone, from ceramic, from bronze, and also from ivory.

Seals and scarabs are also found with armour at some sites. Seals and cylinder seals have been found at Troy (1 example), Tell Deirʿ Alla (5 examples), Ugarit (5 examples), Boğazköy (2 examples) with the largest number having been found at Beth Shan (19 examples). They are made from ceramic, stone, ivory, and most commonly, faience. Scarabs have been found at Beth Shan (9 examples), Tell el-Faraʿh South (5 examples), and possibly also at Ugarit (1 "scaraboid" item), and are predominantly made of stone, with only two of the examples from Beth Shan being made of faience.

4.6.4.2) Discussion of the Associated Artefacts

Scale armour most commonly appears in contexts in which other forms of weaponry have also been found. This is perhaps unsurprising given the military nature of the armour. The association of scale armour with arrowheads further strengthens the association of armour with archers. The association of scale armour with the other types of weapons may however strengthen the hypothesis presented in Chapter 5.1.2 that the soldiers who made use of armour often were highly trained "commando" forces who were accustomed to using may forms of weaponry, and were therefore suitably equipped. The association of armour with the wealthy elite, perhaps as parade armour or similar, is attested to by finds such as the silver-mounted sword found at Ugarit (noted above).

Many of the other forms of artefacts discussed above can reasonably be associated with elevated status. The weights, seals, and scarabs all suggest a general association with an administrative context, particularly those armour scales found in Temple/Sanctuary contexts at Boğazköy, Beth Shan, and Tell Deir 'Alla, and may suggest an accountancy or system of inventory of the more "valuable" dedicatory offerings. The greater numbers of seals and weights found at Ugarit in association with armour scales may also suggest a secular system of inventory and accountancy, perhaps associated with a palace armoury. The large number of general artefacts found in association with armour scales at Ugarit, many from a courtyard context, may suggest that many objects were scattered in the general mayhem of battle and the subsequent looting. Altogether, there seems to be two clear associations with armour: 1) the association with military equipment, and 2) the association with other "luxury" items, with both of these associations being linked with the elite sector of society.

4.7) Conclusion

Few strong correlations can be made with the data presented in the catalogue and database. As noted above, this is due to the small sample size and the broad geographical area from which it has been gathered. The primary conclusion is that various craftsmen manufactured armour to no specific pattern or size, creating each coat of armour as necessary. Particular situations, short-term trends in "armour fashion", and possibly the whim of the armourer and patron may have given rise to slight variations. Furthermore, as the armour was not made on a mechanical assembly line, it is only reasonable to assume that variations in scale size would exist. The size and shape (to a degree) varied within each coat of armour, depending on what part of the body the armour was to protect. For instance, as can be seen in the examination of Tutʿankhamūn's armour (see Chapter 2.3.3), the armour which is tentatively assigned to protect the shoulders is formed of smaller scales of a different lacing pattern than those used in the body of the armour. This principle is also evident in Ventzke's (1983) work on the Kāmid el-Lōz armour. There are, however, no other examples of scale body armour that are as complete as Tutʿankhamūn's, so it is not possible to make any specific comparisons to thereby attain more detailed specifics of the construction of a finished coat of armour.

It is difficult to determine why great extremes of sizes in armour scales were produced. As noted above, the largest and smallest armour scales (from Malqata and from Tutʿankhamūn's armour respectively), may have some bearing on the social status ascribed to those who wore, or were permitted to wear, body armour. It is readily apparent that a great deal more effort would be necessary in the production of a coat of armour as finely made as Tutʿankhamūn's. The contents of his tomb are certainly an indication of his elevated status. Such a tomb is likely context in which the finest, "most expensive" armour might be found, and is, in the case of Tutʿankhamūn's tomb, certainly in keeping with the opulence of the majority of the other artefacts. Although the size of the armour scales was possibly a factor of status, and the associated conspicuous consumption, it may also be that the largest and smallest examples of the armour scales were "experimental".

The finds of the green- and red-glazed ceramic armour scales at Pi-Ramesse (database entry: *Pi-Ramesse 86/0661* and *Pi-Ramesse 87/0814*) in a workshop environment may suggest that some experimentation did occur. Unfortunately it is not possible to verify this from the existing database due to the almost total lack of complete, or even mostly complete, coats of armour. Furthermore, there are no known texts which specifically refer to experimentation with scale armour which might shed light on the subject. It is also possible that the ceramic armour scales may have been intended for a parade armour of alternating colours as seen in the depictions in the tomb of Ramses III (see Chapter 2.1.1, see also Lorimer 1950: 197), or perhaps even for the decoration of a statue. Another variant of armour scales are those which have only a single lacing hole in places where there are more commonly a pair. There are several examples, most notably from Megiddo (catalogue entries: *Megiddo 96/F/AR1* to *Megiddo 96/F/AR3*) which are a variant of Lacing Pattern #5. The use of single lacing holes instead of pairs may not adversely affect the protection afforded by the armour (although this has not been checked by experimental work), but may have decreased the total time and effort necessary in the manufacture of a coat of armour.

As can be seen in the experimental work (see Chapter 3.5), the laces on metal armour scales are a weak point in the design of Late Bronze Age scale armour. The laces used in the experimental work were simple modern cotton butcher's twine instead of thin leather lacing or linen twine (eg. the lacing in Tutʿ‌Ankhamūn's armour is leather). When the metal armour was struck with an arrow the laces between the metal scales directly adjacent to the impact zone tended to fray and often broke. It is quite possible that during battle this may have occurred, resulting in a single or very few armour scales becoming detached from the coat. Over time, the laces in a coat of armour being worn by a soldier could also wear through and break, also resulting in one or more scales occasionally falling away from the armour.

As such, any location in which armoured soldiers may have been present is a potential context in which armour scales may be found. For instance, any location where combat occurred, i.e. elite soldier's barracks, important buildings and other areas which where protected by armoured guards, workshops and armouries, training grounds, and any variety of other contexts, is a place in which armour scales may have been unintentionally deposited through the processes described above. A situation involving armoured guards is suggested by Schaeffer (1962: 103) where guards were stationed at archives or workshops which produced valuable goods, which may well account for the presence of armour scales in contexts which have been identified as archives. It is also possible that, as mentioned above, the armour was deposited during looting in the 1186 BC destruction of the site. As the armour was an expensive item to produce, few if any metallic armour scales were likely to have been intentionally discarded, and no armour scales have yet been found in a rubbish deposit. Complete coats of armour being taken out of active service, but not recycled, would be more likely to show up in a burial context through the processes of conspicuous consumption. Should a coat of armour be recycled, it is already in a convenient form (small pieces of metal) to be re-melted, requiring little or no work in breaking up the item prior to recycling. A damaged coat of armour could also have easily been broken down so the undamaged scales could be incorporated into a new coat of armour, thus leaving little or no trace that the original coat of armour had ever existed.

A clear majority of the armour scales within the database do appear to have been found in association with items generally associated with the elite sector of society. Also, no armour has been found in a context which can definitively be associated with the non-elite population of Late Bronze Age society, a fact which further strengthens the hypotheses that scale armour was linked with the wealthy elite and the highly-trained elite "commando" soldiers (see Chapter 5.1.2). The association of items manufactured of materials primarily available to the elite sectors of Late Bronze Age society (silver, gold, ivory, etc.) further strengthens the hypotheses of armour being the province of the elite, which in previous chapters has been based upon the contemporary texts and depictions.

Should more armour scales be found in future archaeological excavations, the larger sample size may allow further hypotheses. For instance, it is may be possible to hypothesise that the higher the status of a particular locus, the more likely it would be to find smaller armour scales. Unfortunately the publications available at present, and excavation and publication strategies of the past, are such that much relevant information is unavailable for analysis.

Chapter 5

Socio-Economic Considerations on the Use and Manufacture of Late Bronze Age Eastern Mediterranean Body Armour

Introduction

The following text is an examination of the socioeconomic factors that governed the use and production of human scale body armour in the Late Bronze Age Near East. This text discusses the social status of the soldiers who made use of body armour and also discusses the social and economic factors which governed the use and manufacture of armour as a whole. The latter parts of this chapter discuss the possible changes in military equipment brought about by the increased presence of the Sea Peoples, and makes some suggestions as to the principles which gave rise to these changes. Much of the present chapter relies heavily on the military texts from Nuzi which have been presented in detail by Timothy Kendall in his 1974 Brandeis University doctoral dissertation. These texts provide the most complete overview of Near Eastern military provisioning available, and the translations provided by Kendall are discussed below with comparisons and contrasts with other available Near Eastern texts. It must be noted that this bias towards the Nuzi texts is acknowledged, and that although there were certainly many differences in the military organization of different regions, certain elements seem to have been used in markedly similar ways, particularly the elite use of chariotry, composite bows, and scale body armour.

The abbreviations of the various texts discussed below are as follows:

HSS - *Harvard Semitic Series, Excavations at Nuzi*
JEN - *Joint Expedition with the Iraq Museum at Nuzi*
AASOR - *Annual of the American Schools of Oriental Research*
KTU - Texts from Dietrich, Loretz and Sanmartin (1976)
EA - The El-Amarna tablets (Cochavi-Rainey 1999)

5.1) Discussion of the Socio-Economic Systems of Military Production

The military units of the larger polities in the Near Eastern Late Bronze Age all seem to be characterised by the use of units of chariotry. In each of these polities (i.e. Hatti, Egypt, Nuzi) the charioteers appear to have been of a higher social standing than most of the standard infantry soldiers. One of the primary means of assessing this fact are the contemporary texts which concern military matters. They often discuss the charioteers, but rarely discuss the infantry. The ancient texts from the different politics, as discussed in Chapters 2 and 5, do not discuss military matters in the same manner. Texts from Egypt are characterised by the bombastic propaganda commonly found in the contemporary military discourse, while the texts from Ugarit are primarily focussed upon the production of masses of weaponry by the villages and the book-keeping necessary to organize this form of dispersed production. These different forms of text each contribute information on the different aspects of the ancient military with the most important, for this discussion, being the military texts from Nuzi. The Nuzi texts, introduced and discussed in Chapter 2.2.1, are primarily a running inventory of equipment being issued to the soldiers, often noting specifics of the equipment issued, and occasionally including inspection lists in which are found records of soldiers who possessed sub-standard equipment.

The Nuzi military texts are often unclear on the specifics of construction of the armour, as this would not be necessary within an inventory. The numbers of scales within a coat of armour are often listed, and it is this which, to a degree, differentiates the styles of armour available to the soldiers, but details of actual construction are not present. There are 15 different styles of armour noted in the Nuzi texts which include armour made of bronze, of leather, and a composite of the two. There are also a variety of different styles of armour including the *tarkumazi* uniforms, and additional pieces of armour such as the *gurpisu* helmets and the *tutiwa* armoured skirts (Kendall 1981:201-202, 205). Kendall (1981: 203) notes that the forms of composite armour include armour made of leather (*ša maški*), of leathers (*ša maškē*, possibly noting leather scales), of leather with bronze sleeves (*ša maški...ša aḫišunu ša siparri*), of leather with a back of bronze (*ša maški ašar ṣērišu siparri*), of bronze for the breast (*ša irtišu ša siparri*), and of bronze for the body (*ša ramānišu ša siparri*). It is apparent that there were different forms of armour, each possibly intended for different tasks, although no specific information is available for each type. The different types of armour may have been issued to a variety of types of soldiers based on their imminent tasks, and perhaps also with regard to that soldier's social status.

5.1.1) The Military Personnel in the Late Bronze Age at Nuzi and Ugarit

It must be noted that the Nuzi texts present a bias towards the elite members of society. The majority of the texts have been found in the archives of prominent families, and as such refer primarily to the social ranks to which these families belonged (Kendall 1974: 13). With respect to military matters, there is little mention of the infantry and lower-class soldiers, their equipment and their military tasks.

Throughout the military texts from Nuzi it is evident that the majority of the soldiers had access to the necessary military equipment. The majority of information concerning the equipment used by these forces is focussed upon the elite sectors of the military, and perhaps this is partly due to the fact that they, as highly trained professional soldiers made use of more, and more valuable, equipment than the conscripted infantry. While the majority of the texts which discuss provisioning concern the elite chariot forces, it is not known whether these elite soldiers kept their equipment as a personal possession, or if some of them owned their own equipment. As the Nuzi military texts are primarily the inventories of the palace armoury, it would be unlikely that they should include records of the soldiers who owned their own equipment. As it was the role of the military to provide protection for the territory of Nuzi, defending it from attacks on its borders, the palace would have been required to supply the necessary equipment, and as such, a record of valuable equipment is only reasonable. It is not clear whether the wealthiest soldiers were *required* to supply their own equipment, but some certainly may have done so.

Based on Kendall's (1974: 75) reconstruction of the military organization at Arrapḫa, there are a wide variety of levels of military status evident in the Nuzi texts (Fig. 85) [For the overall structure of the Late Bronze Age military establishments at Nuzi and Ugarit, see Kendall 1974 and Heltzer 1982]. For instance, it is certain that some of the royal princes performed some military roles, as Prince Šilwitešup features prominently in the Nuzi military texts, and armour was found in rooms of a wealthy house at Nuzi believed to have belonged to him. It is possible that some of royalty, particularly the princes, may have actually seen combat, although there is no incontrovertible proof. It is however certain that the ranking nobility did have some control over the units of chariotry (Kendall 1974: 59). With this involvement of individuals of the highest social rank, the connection of armour and chariotry is established with the social elite.

The highest ranking officer from Nuzi whose name and rank are both known is found in text JEN 612:15. This text notes that Keltešup son of Ḫutia was a *rab hanša* ("Commander of 50") and also notes 8 lesser officers who presided over an irregular number of chariots (Kendall 1974: 68). The *rab hanša* were in command of the charioteers, and presumably to some unknown extent over the infantry while the *emantuḫlu* ("Commander of 10", also known as the *rab ešreti*), were in command of smaller units of chariotry. The *emantuḫlu* (*rab ešreti*) also commanded the guard units of both the city and the palace (Kendall 1974: 68-69). Although it is difficult to establish the precise order of the ranks, the various military ranks within the corps of chariotry may have used different forms of armour as a mark of rank and status, although little evidence of this exists aside from the bronze armour scales found in the house of Prince Šilwitešup (i.e. database reference *Nuzi.corslet.1* to *Nuzi.corslet.36*), who was known to have been associated with the officers of the chariotry.

Most important for this discussion was the manufacturing sector of the Nuzi society responsible for the production of military equipment. The *šâkin bîti* was in charge of the town arsenal (*bît nakkamti*), and the head of the guild of armourers which included the *sasinnu* (bowyers), *nappaḫu* (smiths), *nangaru* (carpenters/chariot builders), and the *aškapu* (armourers) (Kendall 1974: 72 - 73, 90, 124, 126, 142, 149). These individuals were in contact with, and probably answered to, the palace, showing the strong connection between those manufacturing and allocating the military equipment with those of the governing body.

Within the infantry at Nuzi there were three main types of soldiers. The *sâbû šepê*, which were standard footsoldiers, the *awêlûti qašâti* archers, and the *šukituḫlu* spearmen (Kendall 1974: 71-72, 148, 159). There is little known about these soldiers, as they do not often appear in the Nuzi texts, and little mention is made of the equipment issued to them or the manner in which it was employed, aside from the obvious assumptions (i.e. *šukituḫlu* spearmen using spears, etc.). The infantry at Nuzi were drawn from a wide range of lower class peoples including farmers, smiths, carpenters, merchants, priests, etc. (Kendall 1973: 65). That the armourers, smiths, and carpenters who made the military equipment were drafted into the infantry ranks shows that there was no automatic inclusion of these individuals with the chariotry. Those who made the armour and chariots were not necessarily those who used it, which further suggests that armour and chariotry were primarily the province of the social elite. At Ugarit there is relatively little information on the specifics of any soldiers. Very few Ugaritic texts have yet been deciphered which give the specifics of the construction or allocation of military equipment such as exist for Nuzi. Some texts give a broad idea of the military structure, but for the most part, the Ugaritic texts examined herein are primarily a record of the shipments and allocation of materials to craftsmen and the shipment of finished goods back to the palace. It is, however, possible to calculate the total approximate numbers of soldiers, both infantry and chariotry, which Ugarit could conscript when necessary, and are as follows (Heltzer 1982: 107-108):

šanānu warriors = 80
(their *ḫsnm* [dependents / servants?]) = 98
maryannu warriors = 230
their dependents = 48
šerdana (shardana) warriors = 58
tamkars = 28
hbtnm = 132
mur'u men = 120
their *ḫsnm* [dependents / servants?] = 84
mḏrǵlm guards = 1050
their *ḫsnm* [dependents / servants?] = 149

One of the most ambiguous types of soldier at Nuzi who made use of armour were the *Tarkumazi*. They came from a variety of social backgrounds and seem to have occasionally had more than one title or profession (Kendall 1974: 74, 165). Their primary task seems to have involved maintaining the chariots and issuing them to those who were authorized in their use, with the possibly that there was one *tarkumazi* individual for each stable (Kendall 1974: 74, 162). It is certain that the *tarkumazi* individuals were not always charioteers as the two are clearly distinguished in HSS XIV 15, although they may have served as a form of armed escort/servant as is noted in HSS XVI 398: 14 where a *tarkumazi* is charged with caring for the possessions of six women who are presumably in transit to some un-named location. It was not, however, impossible for a charioteer to become a *tarkumazi*, as HSS XV 39: 15 notes one charioteer who did just this. Given their variety of duties, it is not unreasonable to assume that the *tarkumazi* occasionally made use of some form of armour, particularly in their guard/escort duties. As the *tarkumazi* were servants of the palace, it is not unlikely that they also resided there (Kendall 1974: 164-165).

As functionaries of the military establishment at Nuzi, the scribes must also have had a significant role to play. Text HSS XII 175 notes that a scribe took 2,000 spears of the palace to the town of Tarpašḫe (Kendall 1974: 165). The scribes at Nuzi had a variety of specific tasks: they were to record the registration and distribution/allotment of completed military equipment (and the materials for making this equipment), record lists of persons and the condition of their equipment presumably at the periodic inspections, and the recording of the various items of military equipment that existed (Scafa 1981: 55-56). Given the number of military, and other, documents at Nuzi, there would have been need of a large contingent of personnel to record all of the transactions. This system shows the established link between the palace and the military establishment, both in the production of military goods and the deployment of the forces. The scribes would also have been present at the battles to record both the outcome and the quantities of booty taken or lost, such as occurred after Thutmosis III's victory at Megiddo (see below).

5.1.2) The Charioteers/Maryannu as Highly Trained Military Forces ("Commandos")

The soldiers at Nuzi which could be broadly categorized as "chariotry" can be separated into three specific types. The ***âšib ekalli*** charioteers were professional soldiers who lived at the palace and probably officered the bulk of the chariot-borne militia, while the term ***âlik sêri*** refers to "campaigners" who were charioteers of seniority or great experience (Kendall 1974: 70, 84). Reserve charioteers made up the remaining forces and were of the landowner classes which spent the majority of their time in non-military pursuits (see texts HSS XIII 212 and HSS XV 44) (Kendall 1974: 70). Furthermore, an unknown number of professional Ḫanigalbatian charioteers sent from Mitanni were also stationed about the Arrapḫian territory (Kendall 1973: 63-64). They are termed "martiannu" and are encountered in text HSS XV 31: 26, a term which is almost certainly synonymous with the term "maryannu" (Kendall 1974: 94, 115, 128) which is widely used in the Late Bronze Age Middle East in reference to elite charioteers. While the Ḫanigalbatian charioteers are specifically noted as being martiannu/maryannu soldiers, there is no mention of the Arrapḫian soldiers bearing this title.

The charioteers at Nuzi and Ugarit (and almost certainly in other parts of the Middle East) were generally a privileged group with the individuals originating primarily from the upper social classes and occasionally also from royal lineage (Kendall 1974: 129, Heltzer 1982: 114). In addition to fighting in battles and military campaigns, at Nuzi they often served as city guards, particularly around the city gates (texts HSS V 107 and HSS XV 64), as bodyguards for the royalty (the *šepê šarri*) and other notables, and occasionally as guards for shipments of valuable items (Kendall 1974: 128-129, 154). At Ugarit the charioteers/guards would also have served as bounty hunters for escaped criminals and as mobile guards for caravans and the shipment of valuable cargo (Heltzer 1982: 123-124, Rainey 1965: 24). A similar situation of multiple military tasks existed in the Middle Bronze Age at Mari where, although there were no charioteers, Sasson (1969: 7) suggests that the guards "... were probably much more versatile than their modern counterparts." The variety of tasks which a guard may have been expected to perform could well be the reason that the elite charioteers were often employed as such, as they were a highly trained elite force, capable of dealing with almost any situation that might arise.

Kendall (1974: 128) suggests that being a charioteer would not have been a strenuous job as they were based at the palace, with many of them living there and serving mostly on guard duty. It must be noted here that this is unlikely to be the case. As the chariotry was often stationed just outside the city gates (Kendall 1974: 121, 128), the charioteers were then in position to both defend the portals into the city (as Kendall notes) and also to foray out to other towns or plantations at short notice to reinforce those regions should they come under attack. Furthermore, the impressive array of weaponry with which the chariotry were associated, and the degree of training they would have undergone to become proficient with it, suggests that the life of a charioteer was *not* particularly easy, even if they were privileged and primarily associated with the palaces. For instance, within the elite groups of palace-based charioteers at Nuzi, text HSS XV 48 notes five small numerically unequal platoons of men (*âlik sêri*) who, as noted above, were experienced soldiers and perhaps special elite forces. This particular text notes that these men were stationed in the town of Zizza when it was attacked and defended it when all the other troops fled. As such, it is possible that the *âlik sêri* charioteers were considered amongst the most valuable troops in Arrapḫa. (Kendall 1974: 70, 84), and were much more than strictly charioteers, perhaps serving in the capacity of "special forces" trained to accomplish most any task necessary in their duties and harkening back to Sasson's (1969: 7) statement above..

At Nuzi, the term *rakib narkabâtê* is generally associated with charioteers, and may have referred primarily to the driver of the chariot (Kendall 1974: 132). The *awêlûti qašâti ša rakib narkabâtê* are believed by Kendall (1974: 71) to be the "chariot archers", as their connection to archery is definitively established by the term *awêlûti qašâti*. It is not clear whether both members of the chariot crew used archery, but it is not unreasonable to assume that there may have been times at which one member "drove" the chariot whilst the other loosed arrows into battle. Whether or not this was done from a moving vehicle is uncertain, although archery has been successfully employed from the backs of moving horses to great effect in a variety of cultures both ancient and modern. This form of archery is, most particularly, still practised by the Japanese Shintō monks who have taken this martial art to levels of exceptional ability.

Kendall (1974: 132) suggests that the charioteers at Nuzi fought two men to a chariot, and that they both used archery; one as an accomplished archer and the other while driving with the reins tied around his waist. This analysis is based heavily on the bombastic, propagandistic Egyptian reliefs depicting Pharaoh driving alone in his chariot with the reigns tied about his waist. Driving a chariot with the reigns tied around the waist while shooting would certainly compromise the effectiveness of both tasks. The driver would be somewhat at the mercy of the terrain in directing his course, not to mention the (probably) slightly rough surface causing vibrations which would be detrimental to any degree of accuracy. Added to this is the fact that the confines of a chariot are not conducive to the body movements necessary for two archers to stand abreast and shoot at the same time. Needless to say, the archers would need to face away from each other or stand side-by side to prevent their arms from colliding. Furthermore, loosing arrows forwards, in the direction of travel, over the heads of the horses would also be a poor idea, as being jolted around in the chariot would put the archers at serious risk of accidentally shooting their own horses.

As the charioteers participated in a variety of tasks and appear to have fought in a number of different styles, they would almost certainly have been provided with the specific necessary equipment. The wide range of armour associated with the charioteers (see i.e. Chapter 2.2.1 for discussion of the Nuzi texts) may suggest that they did not have a fixed set of equipment, but were equipped as necessary, based on the tasks they were to perform. Certain tasks would not require that a full range of equipment be kept at hand on the chariot, although this does occasionally seem to occur. Depictions of chariotry from the Late Bronze Age Middle East, particularly in the Egyptian representations, occasionally show chariots equipped with swords, javelins, spears, archery tackle, whips, and shields. Should a task have been better accomplished without the use of armour, then they would most likely have refrained from using it.

The individuals who probably had access to the finest equipment were the king's personal bodyguard (termed the *šepê šarri* at Nuzi). They were not present in large numbers, likely relying on superior training and equipment instead of numbers. In determining the numbers of charioteers belonging to the *šepê šarri* elite royal bodyguard, Kendall (1974: 155-156) has analysed certain texts dealing with the allocation of rations of barley for the chariot horses when the *šepê šarri* went with the king on a variety of excursions. To establish the numbers of charioteers accompanying the king on such an excursion, an examination of Nuzi text HSS XVI 149 shows that horses were fed no more than 4.5 qa. of barley per day (approximately 3.75 litres volume, see Heltzer 1976: 39). On analysing the amount of barley taken along as rations for the horses or the *šepê šarri*, the numbers of horses, and therefore the numbers of royal bodyguards, may be estimated. Given that there is the factor of an unknown number of spare horses being taken along on journeys, seven texts (HSS XIV 48, 50, 55, 59, 60, HSS XV 271, HSS XVI 443) suggest that there were between 9 and 14 chariots in the king's entourage and thus between 18 and 28 *šepê šarri* bodyguards (Kendall 1974: 155-156), each probably being equipped with a full range of equipment.

5.1.3) Late Bronze Age approach to military industry and provisioning

It is certain that the palace-based military establishments of the Late Bronze Age Near East supplied their soldiers with equipment. This can be seen at Medinet Habu in the depictions of Ramses III outfitting his troops prior to the battles with the Sea Peoples (Fig. 16), and can also be seen in the texts from Nuzi and Ugarit. The approach to accumulating the quantities of equipment needed for mass-issue to soldiers was, at Nuzi and Ugarit, based upon systems of taxation wherein goods were manufactured and sent to the palace storehouses, with Egypt operating, perhaps, a similar system. Vast quantities of goods were required to initially supply the troops, with a further stockpile of equipment held in reserve to allow quick replacement of damaged or lost equipment and replenishment of consumable items such as arrows. In total, "expenditure" on the military must have been a major factor in the economics of each of these three territories, as well as many others for which the texts are unavailable.

Much of the military equipment at Ugarit was produced by the *bnš mlk* individuals. The *bnš mlk* were individuals who were connected to the palace ("palace dependants", "royal servicemen", or "persons who are at the disposal of the king") whose labour and produce were taken by the palace in return for service in kind, products, or silver. These individuals were of all different levels of society, sometimes working at their own professions, and sometimes working in other projects under a system of *ilku (*corvée) labour (Heltzer 1982: 3-16). The *ilku* labour, or duty, was not specifically connected with the tasks an individual had to conduct in connection with being a *bnš mlk*, although they may have been similar (Heltzer 1982: 17). The *bnš mlk*, although tied to the Palace, were not all necessarily resident there, often living in the outlying villages. However, some of the craftsmen, such as the cartwrights and (probably) chariot builders, were resident at or near the palace (Heltzer 1982: 100-101).

Craftsmen throughout Ugarit, including the *bnš mlk*, were supplied with their raw materials, particularly bronze, and were required to produce a given amount of goods which were then shipped to the palace as a form of taxation (Heltzer 1982: 100, Gordon 1949: 124). This system provided the products required by the military, and could conceivably include almost any type of product from food to weaponry and armour. In one form or another, most of the people of Ugarit could have been involved in military production (see Gordon 1949: 124). Furthermore, both the *bnš mlk* and the other citizens of Ugarit were required to serve as guards. This was not done through conscription, but through the *ilku* duty system (Heltzer 1982: 14, 16). Some of the *maryannu* charioteers and *mḏrǵlm* guards were also listed as being *bnš mlk*, showing that the *bnš mlk* duties also included the military personnel (Heltzer 1982: 11), and sometimes involved labour of a military fashion as well as any variety of other tasks. It is unclear how the *bnš mlk* duties and the *ilku* duties differed, particularly when both were (i.e.) military tasks required of military personnel.

The *âlik ilki* were individuals who, at Nuzi, had to perform the *ilku* duty which could take a variety of forms (Kendall 1974: 79-80). Kendall (1974: 80) agrees with the CAD (pg. 80) which states that there is no direct evidence that the *ilku* duty was connected with military service, however the *ilku* duty at Ugarit was connected with the manufacture of military goods (Heltzer 1982: 23-48). Nuzi text HSS XV 44 notes the "bowmen who are *âlik ilkī*" which suggests that these individuals were not exempt from military service, but does not indicate that the military service itself was part of their *ilku* duty.

To ease bureaucracy and difficulties in administration, and perhaps also to ease the strain on palace resources, an un-named king of Arrapḫa employed a system whereby the governors and mayors of the various districts and plantations were to ensure the defence of the territory under their control. The *sâknê mati* governors of the *ḫalṣu* districts/provinces, the *bêlû dimâti* suburban plantation owners, and the *hazannû* town mayors were in charge of the defence of their estates and territory, and as such were charged with supplying troops which they levied from within the groups of their own tenants (Kendall 1974: 65, 67). These territories were likely also within easy reach of garrisons of chariotry for added protection, with the larger plantations possibly having resident charioteers (Kendall 1974: 52).

Nuzi Text HSS XV 1 outlines a directive put forth by the king, via the mayor of Tašuḫḫewa, in which he declares that the protection of the outlying towns and plantations was the responsibility of the village and city mayors and plantation governors/owners:

> The mayor of Tašuḫḫewa (speaks) as follows:
> "The king has issued the following orders: 'Any mayor, whoever he is (lit: whoever you are) in his city, his territory, or his frontier, shall watch out. Should there be a plantation in the outlying region of his city which is not properly maintained, (lit: which is fallen down, thrown down) the mayor must watch out, for in the territory of his city, there must be no robberies committed, and no enemies who kill and who steal! There shall be none! And if in the territory of his city (there do occur) robberies of the enemies who steal and who kill, then the mayor shall bear the responsibility. If there is a fugitive from Arrapḫa who from the territory of his city has fled and into another region has entered, then the mayor shall bear the responsibility. Should there be a plantation in the territory of this city which is not properly maintained, then the mayor shall bear the responsibility. But the governor shall give tablets to each of the lords of the plantations, and thus he will establish the orders for them. I swear that if in the vicinity of that plantation there occurs any

> robbery committed by the enemies who kill and who steal, the lord of that plantation shall be considered at fault (lit. Reached with guilt), and the plantation I shall take. You shall draw near, but you shall say nothing, and according to this proclamation, this man, or fugitive, or the enemies [who kill or the ene]mies [who ste]al, or if from...there is with you, you shall seize him, and let him approach the palace." (translation via Kendall 1974: 44).

This edict outlines the responsibilities of the mayors and governors in the protection of their territory, and it is under threat of royal seizure of their estates that they are charged with this protection. The garrisons of each of the cities and plantations were to be stocked with grain and military equipment and was possibly under the military leadership of the city or plantation governor himself (HSS XIII 60, 71, 74, 85, 99, 100, 103, 116; HSS XIV 222-226, 228). The militia who defended the territory was likely formed of the tenants and farmers. This would allow a single plantation or small town to defend itself from small-scale raids. Larger towns would have maintained a professional military garrison which could be combined with the smaller plantation and village garrisons to meet any larger threats (Kendall 1974: 53-55). On a broader scale, the Mitannian Empire seems to have taken steps to ensure the safety of its vassal territories. The territory of Arrapḫa, with Nuzi as one of the more prominent cities, was vassal to Mitanni, and as such may have benefited from this arrangement. It is noted in the texts (i.e. HSS XV 32) that Ḫanigalbatian charioteers were sent to reinforce the garrisons at Arrapḫa (Kendall 1974: 28).

5.2) The Issue and Manufacture of Military Equipment

5.2.1) The Issue of Military Equipment

It is quite difficult to assess the "standard" equipment issued to soldiers in the Late Bronze Age. As might be expected, the equipment would vary both by region and the type of soldier. The ancient texts and depictions describe and depict slightly different armour for Egypt, the Hittite empire, Arrapḫa, and others, and they cover the time-span of the Late Bronze Age, approximately four hundred years. The text below is primarily concerned with the provisioning of charioteers as they were prominent in many parts of the Late Bronze Age Near East. Above all, consideration is given mostly to the issue of human body armour. As has been mentioned in Chapter 1.3, body amour is almost certainly linked into a tripartite arrangement of composite bows, chariots, and body armour, and as such may at times have been issued together. It must also be remembered that the various governing bodies would need to amass a large quantity of supplies and military goods if they were embarking on an extended campaign. For example, Thutmosis III mounted 17 campaigns during his reign (Kuhrt 1995: 193), all of which would required vast economic expenditure on the military.

At Nuzi, the military supplies were stored at the armoury (*bît nakkamti*) and were issued to troops at periodic inspections. The *šâkin bîti*, the individual in charge of the armoury, and his assistants, kept inventories of the equipment and issued it out to the soldiers. For any goods to be taken from the armouries, he or an assistant would either be present or need to be informed (Kendall 1974: 149-150). He also presided over the guild of armourers and ensured that they fulfilled their quotas as they produced equipment for the various armouries in Arrapḫa (Kendall 1974: 72). Each item of equipment taken from the armouries was to be returned (eventually) (Kendall 1974: 228), either when it was no longer needed or when damaged. Perhaps similar to this position was the *rb* at Ugarit who was an "elder" and whose task seems to have been to oversee production of various items (Heltzer 1982: 88). The allocation of military equipment and other provisions was recorded by a large staff of scribes (see Scafa 1981), with the number of these individuals indicated by the large numbers of texts which survive in the archaeological record.

It is most likely that each different type of soldier in the Late Bronze Age Near East would have been issued with the equipment best suited to the tasks in battle which they were to perform. Infantry soldiers tended to receive swords, spears, and often shields, whereas the chariot forces (usually of higher status) tended to receive a more comprehensive selection of equipment. It must be noted that both groups received equipment which was suited to their tasks, but did not receive equipment that was spurious. Larger quantities of equipment would be allocated to the groups of charioteers if they were to serve in a given military venture as elite troops who might be required to undertake an indeterminate number of different tasks. A variety of Ugaritic texts (i.e. KTU 4.145, 4.167, 4.392, 4.88) note that chariots were equipped with archery tackle while text KTU 4.167 notes that the royal chariots "covered with gold (plates)" were equipped with slings, *mḏrn*-weapons, *mšḫṯ*-weapons (possibly hammers or maces), and *msg*-weapons (Heltzer 1982: 192-193). These heavily equipped and decorated "royal chariots" may have been those used by the *šepê šarri* royal bodyguard.

At Ugarit, regular soldiers could be expected to receive a bow, a quiver of arrows, a sling and from 3 to 6 spears (probably javelins) (Heltzer 1982: 109). Similar equipment was issued to the troops at Nuzi, and included shields, and short swords or dirks (Kendall 1974: 175, 245-246) and whips, bows, arrows, and other archery tackle (Kendall 1974: 210, 213). Throughout the Late Bronze Age Near East this equipment would probably be increased for the elite charioteers to include more, and probably better, equipment including armour (if appropriate) and access to chariots. Nuzi text HSS XV 3:33f notes a warrior who is issued with a leather corslet, a copper helmet, and a shield for the right arm (Kendall 1974: 175), which was not the Egyptian approach which was to issue armour only to those who did not have a hand free to use a shield (Yadin 1963: 84).

On the Temple of Medinet Habu in Thebes there is one relief which shows Ramses III equipping his troops for battle against the Sea Peoples (Fig. 16), as presented in the Medinet Habu volumes [Breasted 1930: plate 29]). This relief is heavily damaged, but still shows the military scribes dispensing khopesh swords (Fig. 16a), angular composite bows (Fig. 16b), quivers of arrows (Fig. 16c), spears or javelins (Fig. 16d), helmets (Fig. 16e), and what might be coats of armour (Fig. 16f). The items which may be interpreted as coats of armour appear as plain tunics which are shown stacked together. These tunics do not show any evidence of being covered in armour scales, but this may be due to the loss of painted detail on the relief, or simply the lack of fine detail on such a small area of a large relief which was intended to be seen from the ground. As the tunics depicted in the relief are associated with composite bows, quivers, and helmets, it is reasonable to assume that they may represent coats of scale armour, as this would complete the panoply issued to some of the elite charioteers, although no chariots are depicted in this relief. These items are similar to the types of equipment issued to charioteers at Nuzi and Ugarit.

In some of the Nuzi texts it is noted that some of the soldiers kept their equipment as a personal possession until it was damaged or lost, at which point it was replaced by the armoury (Kendall 1974: 72). The retention of military equipment was probably the prerogative of only the elite soldiers, as personal retention of military equipment by all soldiers would result in the military organization having to produce enormous quantities of general equipment should the conscripted soldiers be required to keep their equipment. Nuzi text HSS XV 44 lists a large number of *aššabu* (tenants/residents) who were released to their homes after a period of military service. There were 536 charioteers, 261 *âlik ilki, 196 nakkuššu,* 82 archers, 66 "archers of the *âlik ilki*", 55 archers of the charioteers, and 26 *aššabu* (Kendall 1974: 93) with, presumably, a similar number of other individuals replacing them. It seems unrealistic from an economic perspective that the palace would have produced double the quantity of the various equipment issued to these soldiers.

At Nuzi the *ašib ekalli*, the "dwellers of the palace", were soldiers known to have been issued with their equipment and who were also required to keep it in good condition. These soldiers may be similar to the group of individuals called *arad ekalli* which was a term connected with all those who were employed by the palace, although it seems that the *ašib ekalli* only lived there (Kendall 1974: 86-88). Nuzi text HSS XV 94 makes note of 83 chariot teams of the *ašib ekalli* who were presumably associated with either the left flank or the right flank of the army. This makes it quite clear that approximately one half of the charioteers of a flank were palace personnel (Kendall 1974: 131), further showing how closely the charioteers were associated with, and depended upon, the palaces. With 83 *ašib ekalli,* and at least as many more charioteers residing at the citadel (Kendall 1974: 67), the cost to the palace to supply military equipment for these individuals would have been fairly high, and in addition there would have been the costs of keeping a stock of replacement equipment at hand and employing specialist craftsmen to manufacture and maintain these items. For instance, text HSS XV 12 is a list of the *ašib ekalli* whose armour was incomplete or needed replacing (see Kendall 1974: 353-355).

The *tarkumazi* individuals, as have been discussed above, were provided with a set of equipment which is also termed a "*tarkumazi*". Primarily, the term *tarkumazi* refers to a (most likely) light armoured uniform, probably made of leather, but also to the whole outfit, as there is occasional mention in the texts (i.e. HSS XV 11.24, 33) of individuals who are "missing the swords of their *tarkumazi*". Nuzi text HSS XV 39:2f suggests that the *tarkumazi* had the accessories of a sword and helmet, while HSS XV 10 and 11.6 suggest there was also an associated skirt as well as (possibly) a pectoral protective disk and a gorget (Kendall 1974: 316-319). It is likely that the *tarkumazi* was also an item that was kept as a relatively permanent personal possession, as in HSS XV 12:1.34 one soldier is said to have "made anew the sleeves of his *tarkumazi*" (Kendall 1974: 221).

One hypothesis that might account for individual elite soldiers (primarily the "special forces") retaining military equipment as a personal possession is that it may have enhanced their effectiveness in combat. Many amateur and professional modern athletes, both in the shooting sports and in others, insist on using only their own equipment as they are accustomed to it. Should they use unfamiliar equipment, perhaps even identical items, they tend to lose confidence, and thus do not perform to the best of their ability. With respect to body armour, especially if was specifically fitted to an individual, personal retention of this equipment would be essential. A soldier would eventually learn precisely how his equipment functioned and become the better soldier for it. This may not have been an economically feasible approach for general conscripts, but it would be almost a necessity for the highly trained elite soldiers. Furthermore, it may have offered a better return on the investment made by the palace on their training and maintenance.

Developing a familiarity with one's equipment may also have extended to the elite charioteers becoming familiar with a particular chariot and team. Within the Nuzi texts, many charioteers owned their own chariots, horses, or both, the palace seeming to have provided the remainder (Kendall 1974: 71). It is not certain whether wealthy families were required to supply their own equipment or if some did so simply because they were able, thus perhaps enhancing their status. In Middle Bronze Age Mari, although not referring to chariotry, the state would provide for the less wealthy individuals whilst the wealthy were to provide for themselves. In a letter sent to Yasmah -Adad it states:

> "Take 400 able-bodied men from the Haneens which you intend to tally in order to place them at the disposal of the palace. 200 of these soldiers, one company, should come from the poor folk. I myself will give good positions in the palace to the poor men, while the well-to-do men will be provided for in their paternal homes." (Sasson 1969: 5).

Whether this system continued into the Late Bronze Age, and where it was practised (if at all) is not known. Furthermore, this may only refer to the wealthy being required to provide their own food. This principle may, however, account for some of the wealthier charioteers owning their own equipment. Kendall (1974: 57) notes that some people of wealth and political power were also charioteers, and therefore may have had to provide for themselves.

To offset the cost of outfitting an entire army, a coalition governing body, such as the Hittites are thought to have maintained at the Battle of Megiddo, may have required each leader to see to his own troops. According to the Egyptian sources some 330 princes were lead by Muwatallis at the Battle of Megiddo (Liverani 1990: 118), and requiring each of them to see to the equipment of their troops would have greatly offset the cost to Hatti. This may also be demonstrated by the fact that Ugarit was under Hittite control for much of the 14th and 13th centuries BC.

Throughout Kendall's (1974) text it appears that coats of armour are issued to officers to be distributed amongst those under their command, and the numbers of coats of armour are usually lower than the number of men they commanded. This may suggest that not all of the charioteers wore armour, and in fact, perhaps even that not all of the highest status charioteers wore armour. Within the annals of Thutmosis III which describe the booty seized at the Battle of Megiddo (see below), there was a ratio of 200 coats of armour seized to 592 chariots. Again, this suggests that there were a considerable number of charioteers who did not wear armour, at least at this particular battle. Furthermore, in Nuzi text HSS XV 13 a number of coats of leather armour and a number of armoured leather back-pads for horses are noted as having not been taken to battle at Zizza (see Kendall 1974: 279). This, too, may indicate that not all of the charioteers wore bronze armour, assuming that the armour listed in the text is all associated with chariotry, rather than both infantry and chariotry. It may be that armour was taken to the battle and allocated to the soldiers most in need of it as the battle was about to begin, once the commanders had an idea of what situations might occur during the battle.

The archers in the Late Bronze Age Near East also received their equipment from the palace armouries. The archers at Nuzi fall into at least three categories, with text HSS XV 44 lists

55 "archers of the charioteers", 66 "archers of the *âlik ilkī*", and 82 individuals listed simply as "archers" (Kendall 1974: 96). This single text implies that, at that particular point in time, there were at least three different types of archer at Nuzi; a group of archers which were definitely associated with the chariotry, archers which were required to fulfill *ilku* duty who may have been linked to the chariotry, and standard archers who perhaps belonged to infantry units. As such, it is uncertain which archers received armour. The generally accepted theory suggests that infantry archers in the Late Bronze Age Near East received armour because they did not have a hand free to use a shield, but for Nuzi, such information is inconclusive. Nuzi text HSS XV 3:33f notes a warrior who was equipped with a leather corslet, a copper helmet, and a shield for the right arm [also possibly indicating this individual was left-handed] (Kendall 1974: 175), which suggests that there were instances where armour and shields were both issued at the same time, although there is nothing to suggest that this soldier was an archer.

Nuzi text HSS XV 69 notes that there were, at one point, 21 archers under the command of an officer called Kurmišenni, while text HSS XV 5: 22 notes that Kurmišenni was in receipt of 4 coats of armour, 2 in the style of Ḫanigalbat and 2 in the style of Arrapḫa (Kendall 1974: 96), although it is not certain for whom these coats of armour were intended. Kendall (1974: 97) continues, suggesting that the armour may have been for the chariot driver while the Arrapḫian armour was intended for the archer. This hypothesis is acceptable in that the long, cumbersome sleeves of the Ḫanigalbatian armour (see Chapter 2.2.1.2) would be a hindrance to an archer and could possibly impinge upon the line of string movement during a shot, greatly decreasing accuracy and putting the bow at a risk of damage from a broken string (should it be cut on the scales of the armoured sleeves). A bracer, or arm guard, is generally worn by archers to prevent the string from striking the inner forearm and causing bruises, but this item is always quite thin, fitting flush with the arm. A thick, padded garment covered in leather or metal scales would present the distinct possibility of a broken bowstring. A broken string would put both the bow at risk (breakage) and the archer, as his primary weapon would then be beyond use for at least the time it would take to re-string the bow. In the middle of a battle, equipment failure would certainly be undesirable.

There is also the possibility that armour was not always directly issued to soldiers as a separate item. In some of the Nuzi texts there are coats of armour which are said to be associated with particular chariots rather than with particular soldiers (Nuzi texts HSS XV 12:4f and HSS XV 82; Kendall 1974: 281). This may reflect a system to address the value and complexity of the armour itself. With the high numbers of charioteers at Arrapḫa, it is unlikely that each of them could have owned their armour, so when the charioteers had finished a period of active service and were "released to their homes" (see Kendall 1974: 93) the armour and other equipment may have remained with the chariot, ready for the next pair of charioteers to use, thus decreasing the quantity of equipment that the palace armouries needed to produce. For the professional soldiers who resided at the palace, the armour may have been more-or-less on permanent issue, hence the soldiers who are said to have kept the armour as a personal possession.

At Nuzi each soldier is thought to have possessed two bows (Kendall 1974: 210), and Starr (1939: 473) notes that arrowheads were very common in the private houses. This may be a reflection of the military equipment that each soldier was required to maintain as a personal possession. It is uncertain whether these bows were the complex horn-wood-sinew composite bows or simple wooden self-bows, but the likelihood is that it may be the latter, as the time and expense of making composite bows (see Bergman, McEwen, and Miller 1988: 660, Miller, McEwen, and Bergman 1986: 183-185, McLeod 1958: 400), especially in these numbers, is very high. Kendall (1974: 98) suggests that all men might have carried bows into battle, which may be reflected in the presence of archery tackle in many private houses. The presence of archery tackle in the private houses may indicate that bows were also kept for hunting and sporting purposes.

The importance of military archers, whether chariot-borne or on foot, is noted by the quantities of arrows requisitioned from the armouries and storehouses of Nuzi. Three particular texts from Nuzi note the large quantities: 1) text AASOR XVI 90 notes that 10,000 arrows were taken from Nuzi to Dûr-Ubla, 2) HSS XIV 177 notes that 3,000 arrows were received by the town of Ḫuraṣuna-Rabu, and 3) HSS XIV 224 notes that 2,000 arrows were requisitioned by the Mayor of Irḫaḫḫe (Kendall 1974: 26). To assess the numbers of arrows that would be involved in a campaign, an examination of several texts may illustrate the numbers of arrows required on a campaign. Text HSS XV 18 notes that 161 chariots plus officers went on campaign (Kendall 1974: 31), while text HSS XV 21:10 notes that each chariot carried two bows and one or two quivers (Kendall 1974: 211).

A variety of texts note that a quiver generally contained from 25 to 37 arrows (HSS XIII 195:3f, HSS XV 142:12, JEN 527:27f, HSS XIV 616:15f, etc.) (Kendall 1974: 212), so an average of approximately 30 arrows per quiver is not unreasonable. With the chariots having one or two quivers each containing the "average" 30 arrows, the 161 chariots which went on campaign (see HSS XV 18 above), there would have been between 4,830 arrows (at one quiver per chariot) and 9,660 arrows (at two quivers per chariot) in use on this particular campaign. This figure does not take into account the numbers of arrows carried into battle by the infantry archers, nor the arrows in quivers worn by the charioteers on their backs. Assuming that these charioteers were probably maintained in a state of readiness, this also does not take into account the numbers of arrows (and other equipment) kept in storage in the palace armouries to outfit infantry and to replenish the troops during a war or campaign. All together, there must have been tens of thousands of arrows allocated to soldiers at any given point in time, which would represent a very high expense for the military establishment or palace. It is probable that there would be an attempt to retrieve as many arrows as possible after any skirmish or battle, but it must be remembered that arrows were a "consumable" military item, and as such, especially when a large battle was being waged, there would certainly have been a large number of arrows held in reserve.

5.2.2) Manufacture of the Armour

The armour at Nuzi, and probably also at Ugarit, was assembled by the *aškapu* (the guild of leatherworkers) whose primary role was that of a tanner, although evidence concerning the particular tasks undertaken by the leatherworkers at Ugarit is scarce (Heltzer 1982: 83, Kendall 1974: 73, 91). At Nuzi the construction of the armour was a joint effort involving the manufacture of textiles for a backing material, the tanning of leather (also possibly for the backing material), and the manufacture of the bronze armour scales. It was the task of the *nappaḫu* metal-smiths to make the armour scales (*kursintu*) used in the manufacture of the armour (Kendall 1974:

126, see also "*nappahu*" in Heltzer 1982: 91), as well as cast and finish the myriad other metal items necessary for outfitting the military. It is important to note that the armour at Nuzi was assembled by the leatherworkers, which may suggest that the majority of the armour was made of a hide product. If the majority of the body armour manufactured was made of metal, it might have been more likely that it was assembled by one of the groups of metalsmiths, several types of which existed at Ugarit (see Heltzer 1982: 92-94).

The craftsmen of Ugarit were provided with materials to produce products which were then shipped back to the palace for redistribution (Heltzer 1982: 100). It is very likely that the same system was employed at Nuzi. For example, Nuzi text HSS XV 195 notes that Ḫutiptilla was given hides and 12 sets of thongs to make armour of the *Kiniwana* type. He was also given 7 goat skins to make 3 *gurpisu* helmets (HSS XV 196: 14f) and also used 1 mina (60 shekels, c. 504grams) of wool for each, perhaps as padding (HSS XV 208: 9f). Another text notes that on a different occasion Ḫutiptilla was given 580 scales for making 3 *gurpisu* helmets (HSS XV 9b).

In this system, parts of a coat of armour could be manufactured and shipped to the palace, or another craftsman, for final assembly. Armour scales could be made to "military specifications" set by the state, and shipped from a variety of individual craftsmen to a specialist armourer for completion. This may be the origin of the specific terms for armour scales, such as at Nuzi where there is mention of armour scales of the *kakaniašwa* type (Kendall 1974: 213), although it is not known specifically to what this term refers. It is possible that the term refers specifically to horse armour (see Kendall 1974: 213), with the *kakaniašwa* armour scales perhaps being made of either leather or bronze (see Database item *Nuzi 1930.76.8*). Horse armour is also clearly distinguished from human armour in the Ugaritic texts (for example text KTU 4.169 in: Heltzer 1982: 3). This system shows quite clearly that craftsmen in Nuzi and Ugarit were employed for their particular skills. Due to the large amounts of military equipment needed to outfit and maintain a standing army it may have made economic sense to employ general craftspeople rather than specialists. The concept of the *ilku* duty at Ugarit allowed the state to obtain its taxes in the form of manufactured goods. This would have allowed an increase in overall production, whilst allowing specialists to assemble the finished goods.

5.2.3) Manufacture of the Archery Tackle

Throughout the Nuzi military texts there are examples of troop inspections and notes when their equipment was sub-standard. Several texts (i.e. HSS XV 18, 21: 9, see Kendall 1974: 252, 261) note individuals whose bows were "weak" or "no good" who were presumably to receive replacement equipment from the palace armouries. This implies a certain life-expectancy of the bows, and therefore a certain continual need for the manufacture and maintenance of surplus equipment at the armouries. There is no direct evidence that composite bows were made at Nuzi, although given the general use of this type of bows in the Late Bronze Age, it is likely that they were composite rather than all-wooden self bows (Kendall 1974: 260).

At both Nuzi and Ugarit the bowyers were termed "*sasinnu*", and are believed to have produced both bows and arrows (Kendall 1974: 142, Heltzer 1982: 89). Nuzi Text HSS XIV 586(221) shows that Unapta'e, who was a *sasinnu* and foreman of the guild, was contracted to produce 5,000 arrows for the fulfilment of his *iškaru* duty [work done for a higher authority, or goods given/produced for it, and similar to the *ilku* duty] (Kendall 1974: 142, 206). At one point, Unapta'e and another individual were in receipt of a shipment of 20,000 *qanâtu šulê* (presumably raw reeds) for making *šukudu* arrows. This quantity would provide one quiver of 40 arrows for each individual of a 500-man unit (Kendall 1974: 256). It is uncertain whether or not each of these arrows had a metallic arrowhead attached. Although arrowheads were common at Nuzi (see Starr 1939: 473), it is possible that many of these arrows had simple wooden points similar to the long ebony bodkin points found on many of the arrows from the tomb of Tutʿankhamūn (see McLeod 1982). As has been shown by the experiments in Chapters 3.4.1 and 3.5, arrows fitted with wooden bodkin points were quite effective at piercing the unarmoured target and still relatively effective against the rawhide armour at close distances; effective enough to render an incapacitating wound and thus remove a soldier from battle. It must be noted that arrowheads, like armour scales, are small and of a size suitable for inclusion directly into a crucible during recycling, thus decreasing the chance of being found in large numbers in the archaeological record.

The *sasinnu* at Nuzi were also in receipt of large amounts of wool which Kendall (1974: 143) suggests may have been made into bowstrings. Baker (1993: 250-251) examines 31 natural animal and plant fibres but does not discuss wool. For example, in his analysis of the use of cotton, he states that it makes a "poor" string, as the relatively weak fibres must be made into a thick, heavy string which would rob significant performance from the bow. In personal communication with Baker (31/05/2001) he suggests that the relatively high elasticity of wool would cause it to make a very poor bowstring. At worst, a useable string could be made from wool so long as it was made thick enough. Bowstrings rarely survive in the archaeological record of the Late Bronze Age Near East, the only known fragments to date having come from the tomb of TutʿAnkhamūn (artefact #370 MM) and were made of four twisted main strands of multi-ply gut (Carter's unpublished card catalogue (Griffith Institute), McLeod 1970: plate 13). In Baker's (1993: 251, 256) opinion highest quality gut will make a "good" string, while average quality gut will make a "fair" string, again based on the mass to strength ratio. Given the common usage of linen for textiles in ancient Egypt, it may be that the majority of Late Bronze Age Egyptian bowstrings were made of this eminently suitable material, however none survive to put proof to this hypothesis. As a result, it is unlikely that the *sasinnu* used the wool to make bowstrings, but perhaps they used it for padding in bow-cases, or for some other aspect of military production.

5.2.4) Manufacture of the Chariots

The Nuzi texts note that the chariots were made by a joint effort of the *aškapu* (the guild of leatherworkers) and the *nangaru* (the guild of carpenters). The *nangaru* carpenters probably also served as wheelwrights, coopers, and cabinetmakers in a civilian role, but for the military industry, the functions of chariot builder and wheelwright were probably more important. Again, the same is likely true for Ugarit (see text KTU 4.145 in Heltzer 1982: 87). Furthermore, it is noted in Nuzi text JEN 665: 7 that the *nangaru* were of extreme importance on campaign to maintain the chariots and effect repairs (Kendall 1974: 73, 124-126). The *sasinnu* bowyers were also connected in some way to the building of chariots (Kendall 1974: 143), probably in connection with the "bent-wood" technology they employed in the manufacture of archery tackle. This once again shows that the manufacture of complex military equipment was accomplished by specialists each working in his or her area of expertise. Upon completion, the chariots were turned over to the *eruḫlu* who may have been official inspectors of the finished chariots (Kendall 1974: 73, 109), which implies that certain individuals served to ensure that sub-standard equipment was noticed, and presumably repaired, prior to the equipment being accepted.

In addition to manufacturing chariots for the military, the chariot-building teams also produced chariots for non-militaristic purposes. In Nuzi text JEN 494 the king requests that upon arrival an individual be given a "light chariot"(Kendall 1974: 107). This implies that there were different types of chariots available for use at that point in time. Heavier chariots, armed and armoured for battle, would be less useful for daily, domestic use, and in the same vein, a light unarmed chariot may have been less appropriate for most combat situations. Also, it may be the light chariot requested by the king was a one-person chariot intended for fast travel rather than a two-person chariot intended for battle or slower transport. The various chariots from the tomb of TutʿAnkhamūn may be taken as an example, showing that some were utilitarian, whereas others were too highly decorated for anything but parades or display (see Littauer and Crouwel 1985). Furthermore, although evidence is lacking, it might be hypothesised that there was more than one type of chariot used in combat.

5.3) The Cost of Chariots and Body Armour

5.3.1) The Texts

The Amarna letter EA 22 (see Cochavi-Rainey 1999) lists the great number of goods sent in approximately 1376 BC to Egypt by Tushratta, the King of Mitanni, as a dowry for one of his daughters when Amenophis III took a Mitannian princess as a bride. Amongst the goods are listed a wide variety of military equipment including the armour listed here (Cochavi-Rainey 1999: 71, 89):

(37) 1 cuirass set, of bronze. 1 Helmet, of bronze, [f]or a man.
(38) 1 cuirass set, of leather. 1 helmet, [of b]ronze,
(39) for the *sarku*-soldiers. 1 cuirass set,
(40) of leather, for horses, set with *ri[ing]s* of bronze.
(41) 2 helmets of bronze, f[or ho]rses.

Included in text EA 22 are selections of spears, bows, daggers, knives, chariots, horses, horse tack, maces, and other military equipment. A total of more than 6,100 arrows of various types and 105 bows are also included in this set of gifts. It is notable that the three coats of armour, 2 human and 1 equine, feature alongside large quantities of items made of gold, silver and other precious materials.

Kendall (1974: 264) notes: "... and listed as they are amongst such an incredible array of precious objects, their plainness is conspicuous." On the contrary, upon consideration of the complexity and cost of manufacture of these items, and the general association of armour with high status, it is not at all surprising to find them listed amongst the gold, silver and other precious items. It might be suggested that the inclusion of leather armour in this huge dowry might indicate that coats of leather armour were considered to be of great value, possibly for the craftsmanship rather than the materials from which they were made. The coats of armour could only be considered "plain" due to their lack of precious metals and adornment. As these coats of armour were considered appropriate for inclusion in a royal dowry, it shows that there was a direct link between armour (made of any material) and the highest levels of social status.

It is probably impossible to estimate the "value" of a soldier's life in the Late Bronze Age, but it does seem that the value of a coat of armour was less. This, of course, depends on who the soldier was (i.e. nobility or not), and from whose perspective the "value" was judged. At Nuzi there are several texts (i.e. HSS XV 12) which state that a soldier's armour is said to have been "cast off behind him" in battle (Kendall 1974: 221). It is unclear whether this was to facilitate a more rapid retreat, or because the armour had become damaged during the battle and thus became more a hindrance than a benefit. Unlike the texts which note specific counts of metal scales (see the Nuzi texts in Chapter 2.2.1.2), there is no record of the specifics on the discarded armour. Should a charioteer, wearing the heaviest of coats of scale armour, have been forced to run on foot from the battle (i.e. due to injured chariot horses), it might have been a life-saving act to remove various pieces of armour. Noted specifically in text HSS XV 12 is the disposal of the *tutiwa* armoured skirts which would have made it considerably more difficult to run. Neck guards (gorgets) are also often mentioned as having been cast off (HSS XV 12:16 noting the *tikku* neck-guards being "cast off"; see Kendall 1974: 321), perhaps to increase a soldier's angle of vision. Although there is no particular evidence to determine the precise shape and form of this piece of armour, it may have taken the form of the tall tubular "gorget" on the armour depicted in the tombs of Kenamun and Paimosi (see Figs. 8 and 10). Given the different social ranks from which the soldiers originated, it may have been the prerogative only of soldiers of greater wealth or social status to dispose of armour if the need arose. Should the battle have been eventually won, the armour could conceivably been retrieved later in the day.

The term *tarkumazi*, as noted above, in the Nuzi texts refers to both an individual belonging to the group of *tarkumazu*-men associated with the maintenance of chariotry and also to a particular type of "uniform" worn by these men. It might also be said that the *tarkumazi* was not a particularly effective garment, as in Kendall's (1974: 317) discussion of the *tarkumazi* uniform he notes that there are 12 texts (HSS XV 6, 8, 10, 11, 12, 12:3, 14, 15, 16, 18, 26, and 39:6) in which it is specifically noted that "his *tarkumazi* was thrown off behind him"; more than for any other form of armour mentioned in the Nuzi texts. It is possible that this garment was more of a display uniform than a functional one.

The following text, as has been presented in Chapter 2, notes the booty which Thutmosis III seized after the Battle of Megiddo:

> - "[List of booty which his majesty's army brought from the town of] Megiddo. Living Prisoners: 340. Hands: 83. Horses: 2,401. Foals: 191. Stallions: 6. Colts: —. One chariot of that foe worked in gold, with a ⌜pole⌝ of gold. One fine chariot of the prince of [Megiddo], worked in gold. [Chariots of the allied princes: 30]. Chariots of his wretched army: 892. Total: 924. One fine bronze coat of mail belonging to that enemy. One fine bronze coat of mail belonging to the prince of Megiddo. [⌜leather⌝] coats of mail belonging to his wretched army: 200. Bows: 502. Poles of *mry*-wood worked with silver from the tent of that enemy: 7. And the army of [his majesty] had captured [cattle belonging to this town] ------: 387. Cows: 1,929. Goats: 2,000. Sheep: 20,500." (Lichtheim 1976: 33-34, see also Pritchard 1969a: 237 [similar]).

This text states that a total of 924 chariots were seized by Thutmosis III, but that only 202 coats of armour were seized. This clearly suggests that not every charioteer wore armour. In fact, with at least two, if not three, charioteers per chariot, approximately only one in four or five charioteers had armour. Furthermore, the ratio of 200 coats of leather armour to 2 coats of bronze armour suggests that the economics of the production of such a large amount of armour was a factor in the decision of who would use it. It is, of course, possible that some coats of armour were too badly damaged to bother being included in the booty lists, but even these would still retain useable armour scales which could be recycled or held in reserve for the repair of other less damaged coats of armour. That leather armour appears here and in the Amarna dowry lists (see above) shows that they were quite a valuable item, and worthy of inclusion in the ancient texts. As has been described above, there were likely several different types of charioteers, not all of whom made use of armour.

Many charioteers at Nuzi are thought to have owned their own chariots (see Nuzi text AASOR XVI 70), and perhaps even a few owned a second, spare chariot (HSS XV 21:9) (Kendall 1974: 130). With consideration of the "light" chariots discussed above, and given the variety of chariots found in the tomb of Tutʿ Ankhamūn (see Littauer and Crouwel 1985), the privately owned "spare" chariots may not have been suitable for battle. The ownership of one or more chariots may be partly determined by geographic location. In regions where suitable wood was available (i.e. Ugarit, see Heltzer 1978: 9, 36-38, 80-81) in reasonable quantities, it may have been economically feasible for non-royalty to own one or more chariots. In areas with little indigenous timber (e.g. Egypt) the cost of importing the wood then manufacturing the chariot may have been too costly for all but the state and royalty. Elm, tamarisk, and birch-bark have all been identified on the chariots found in Tutʿ Ankhamūn's tomb as well as on a unprovenienced non-royal Egyptian chariot in Florence (Littauer and Crouwel 1985: 105-108). Tamarisk is native to Egypt, but the elm and birch-bark were imported materials which show that there was a combination of woods used in construction (Littauer and Crouwel 1985: 102). This shows that the cost of manufacturing of chariots in Egypt was reduced by using indigenous woods where possible, and importing the remainder. At any rate, personal ownership of chariots in the Late Bronze Age Near East was primarily restricted to the wealthy, elite sector of society.

5.3.2) The "Monetary" Cost of Manufacturing Coats of Armour in New Kingdom Egypt

The costs of manufacturing military equipment is rarely mentioned in the ancient texts. Only one text, from Egypt, mentions the cost of a chariot, and only one text, again from Egypt, notes the cost of a coat of scale armour. Neither of these documents are descriptive enough to enable a detailed analysis, and values (in *deben* weights) do not specify the particular material or metal. The following analysis, such as can be made, is only intended to give very broad idea of the cost of these two military items. The cost of the objects in other parts of the Late Bronze Age Middle East could vary widely due to the local cost of raw materials and the cost of labour. Certain areas of the Middle East would also have had to rely on imported materials, such as the Egyptian reliance on imported wood for some chariots parts.

The cost of a coat of rawhide scale armour appears in the *Papyrus Mallet* (*Papyrus Louvre* no. E 11 006) which dates to the reign of Ramses III [c. 1182-1151 BC]. Janssen (1975: 398-401) discusses the cost of leather and leather products, and suggests that there was no distinction commonly made between raw and tanned hide products in New Kingdom Egypt. The words *dḫrì* and *ẖnt* refer to the hides of large animals and the skins of small animals respectively. This terminology is not unlike that used in the modern tanning industry where the term "hide" refers to the skin of a larger animal (i.e. cattle and large animals), and "skin" refers to the skin of smaller animals (i.e. sheep, calves, rabbits, etc.) (see Appendix 2). The armour noted in the Mallet Papyrus is most likely made from the *ẖnt* (skin) of a sheep or goat.

There are two items described in the text, one a "raw", or untanned, *ẖnt* (preceded by the determinative *pr*) and the other a *ṯryn* made of a *ẖnt*. The word *ṯryn* has been determined to mean a mail-shirt (a coat of scale armour), as the word *mss* is sometimes preceded by the determinative *ḥsmn* which stands for bronze, hence meaning a "bronze tunic". In the booty lists for the 18th Dynasty (i.e. the Battle of Megiddo), the *mss* tunic is preceded by the determinative for leather and is thought to be the Syrian סֹרְיוֹך , which has been written in 19th Dynasty Egypt as *ṯryn* (Janssen 1975: 260).

For the following calculations, one *deben* is calculated as being 91 grams and one shekel as 8.4 grams. The first item in the list, the "raw" *ẖnt* skins were given a price of 2 *deben* (21.7 shekels ≈ 182grams) each (4 *pr ẖnt* for 8 *deben*), while the single *ṯryn* (coat of leather scale armour) is given the price of 5 *deben* (54.2 shekels ≈ 455grams) (Janssen 1975: 400). Janssen (1975: 401) suggests that the increased cost of the coat of armour (*ṯryn*) was due to the craftsmanship involved, namely that it had been "cut and sewn", and it is certain that the craftsmanship involved in the manufacture of a coat of scale armour would increase the cost of the finished product. If the cost of the two skins used in construction of the armour was 2 *deben* of a total cost of 5 *deben*, then a total of 3 *deben* was the cost of the labour. However, three *deben* would probably not be a sufficient sum given all the component parts and the labour involved. Furthermore, there is no record whether this armour is a waist length, sleeveless garment such as from TutʿAnkhamūn's tomb, or a full-length, short- (or long-) sleeved coat such as is mentioned in the Nuzi texts or as depicted in the tomb of Ramses III (see Chapter 2.1.1). A coat of scale armour, based on the coat of rawhide scale armour from the tomb of Tutʿ Ankhamūn (see Chapters 2.3.3.4 and 3.1.1.3), would need to include six layers of linen as a backing (perhaps equivalent to 6 very light tunics), a thin lining of tanned leather, a quantity of lacing and cordage, and the processed raw sheep or goat skins for the scales.

To assess the cost of the backing garment to which the armour scales were fixed, one must examine the cost of cloth and clothing. Lengths of cloth appear in the ancient texts and are termed either *mrw* or *pry* which Janssen (1975: 286) suggests are synonymous. In *Ostraca Deir el-Medina* 187, 5-vs.1, the measurements for a *pry* (or *mrw*) length of cloth is noted as being 3 cubits and 3 palms in length by 5 palms in width (c. 1.80m x 0.375m) (Janssen 1975: 286). Depending on the finished dimensions, it is uncertain how much cloth would be needed for the backing material in a coat of scale armour, however the six layers of linen needed for the backing material in the coat of armour from the tomb of Tutʿ Ankhamūn could probably have been made from three such lengths of cloth. The price for a *mrw* length of cloth is given in *Ostraca University College London* (dated to the second regnal year of Sethnakhte, c. 1185 - 1182 BC), is given as 1.5 *deben* (Janssen 1975: 286). In this case, three *mrw* or *pry* would cost 4.5 *deben* of bronze (presumably).

Little information exists concerning the cost of a tanned sheep or goat skin. The cost of a raw sheep or goat skin in *Papyrus Mallet* is 2 *deben* (Janssen 1975: 400), and although it is uncertain if this is in *deben* of bronze or of silver, but it is probably bronze (see Janssen 1975: 101-111 for an analysis of weights and values). The process of tanning a hide involves the same processes as producing a rawhide skin (suitable for use in i.e. armour) except that the rawhide skin is then subjected to the tanning reagents (see Appendix 2). The tanning of a freshly flayed hide or skin will inevitably increase the cost of the final product, there is however no Late Bronze Age evidence for the cost of the actual tanning process. For the present analysis, the cost of a tanned sheepskin will be taken as 2 *deben* of bronze, the same as for an untanned, raw sheep or goat skin. A whole sheep or goat skin would not be necessary for the production of the thin inner lining of a coat of armour similar to Tutʿ Ankhamūn's, and it is suggested here that one half of a skin would be sufficient, therefore making the cost or this material 1 *deben* of bronze.

The cost of the raw materials for the production of a coat of rawhide scale body armour is taken as:

1 rawhide sheep or goat skin (for armour scales)	2 *deben* of bronze
½ tanned sheep or goat skin (for the leather lining)	1 *deben* (or more) of bronze
3 *mrw* / *pry* lengths of cloth (for the backing)	4.5 *deben* of bronze
fibre cordage and leather lacing	negligible
Total	7.5 *deben* of bronze

Janssen (1975: 101-111) calculates the value of bronze to silver at a ratio of 10 units of bronze equalling 1 unit of silver. As such, with the raw materials costing a total of 7.5 *deben* of bronze (equaling 81.25 shekels [682.5grams] of bronze, or 0.81 shekels [6.825grams] of silver, this would mean that of the 5 *deben* (54.2 shekels [or 455grams]) of silver which the armour "cost", as described above, 4.925 *deben* (53.4 shekels [448.2grams]) was the cost of the labour involved in manufacture. Should the cost noted in *Papyrus Mallet* be 5 *deben* of bronze (rather than silver), it likely reflects the cost of the materials without time and effort of manufacture being taken into account. The number of variables in quality of materials and particulars of construction preclude the accurate assessment of the cost of a coat of rawhide scale armour, particularly when there is only the one known reference.

In an attempt to differentiate between the cost of rawhide and bronze coats of scale armour, the cost of the rawhide scale armour noted in *Papyrus Mallet* will here be taken as 5 *deben* of silver. The difference in the cost of the materials between a rawhide and bronze coat of armour would be significant, with the basic cost of the bronze being the greatest factor. In his analysis of the scale armour from Kāmid el-Lōz, Ventzke (1986: 177-179) suggests the weight of the scales, minus the backing material, for different styles of bronze scale armour coats would range from 7.44kg to 26.67kg (see Table 1, see also Chapter 2.3.1.6). The *deben* weight equivalents would be 81.8 *deben* (885.7 shekels [7.44kg]) for the lightest coat and 293.0 *deben* (3175.0 shekels [26.67kg]) for the heaviest. These figures suggest that the cost of raw materials in a coat of bronze scale armour would be *much* higher than the cost of the raw sheep or goat skins. Essentially, the cost would be the metal weight plus the cost of the raw materials described above in the rawhide scale armour, minus the cost of the raw sheep or goat skin (2 *deben*) used to manufacture the rawhide scales. The total cost of materials would be 87.3 *deben* of bronze for the lighter armour and 298.5 *deben* of bronze for the heaviest.

The cost of manufacturing a coat of bronze armour would also be significantly higher due to having to form the bronze into sheets from which the scales could be cut and formed. After the bronze scales were produced, the amount of time necessary to finish a coat of scale armour would, given equal form and size, be the same as for assembling a coat of rawhide armour. While the 4.9 *deben* (of silver) manufacturing cost, as noted above, would be somewhat higher for a bronze coat of armour given the greater effort needed to fashion the individual scales, the majority of the expenditure on a given coat of metallic scale armour would be in the raw material itself, particularly the bronze.

The armour found in the tomb of TutʿAnkhamūn was likely somewhat similar to the Ventzke's (1986: 177-179) *Type A* armour (see Fig. 22), a sleeveless waist-length tunic or vest. If the coat of rawhide scale armour noted in *Papyrus Mallet* is also similar to TutʿAnkhamūn's armour, and although they are presented here only to provide a comparison, the following three examples will show the relative difference in cost between bronze and rawhide armour:

1) Rawhide scale armour (i.e. armour from the tomb of TutʿAnkhamūn or Ventzke's *Type A*)

1 rawhide sheep or goat skin	2 *deben* of bronze
½ tanned sheep or goat skin	1 *deben* (or more) of bronze
3 *mrw* / *pry* lengths of cloth (linen)	4.5 *deben* of bronze
Fibre cordage and leather lacing	negligible
Total cost of materials	7.5 *deben* of bronze ≈ 0.075 *deben* of silver
Total cost of labour	492.5 *deben* of bronze ≈ 4.925 *deben* of silver
Total Cost of Rawhide Armour	**500 *deben* of bronze ≈ 5.000 *deben* of silver**

2) Bronze scale armour (i.e. armour from the tomb of TutʿAnkhamūn or Ventzke's *Type A*)

Bronze for making armour scales	81.8 *deben* of bronze (weight)
½ tanned sheep or goat skin	1 *deben* (or more) of bronze
3 *mrw* / *pry* lengths of cloth (linen)	4.5 *deben* of bronze
Fibre cordage and leather lacing	negligible
Total cost of materials	87.3 *deben* of bronze ≈ 0.873 *deben* of silver
Total cost of labour	492.5 *deben* of bronze ≈ 4.925 *deben* of silver
Total Cost of Bronze Armour	**579.8 *deben* of bronze ≈ 5.798 *deben* of silver**

3) Bronze scale armour (i.e. Ventzke's Type D; full-length armour including armoured skirts)

Bronze for making armour scales	293.0 *deben* of bronze (weight)
½ tanned sheep or goat skin	1 *deben* (or more) of bronze
3 *mrw / pry* lengths of cloth (linen)	4.5 *deben* of bronze
Fibre cordage and leather lacing	negligible
Total cost of materials	298.5 *deben* of bronze ≈ 2.985 *deben* of silver
Total cost of labour	492.5 *deben* of bronze ≈ 4.925 *deben* of silver
Total Cost of Bronze Armour	**791.0 *deben* of bronze ≈ 7.910 *deben* of silver**

The total cost of the raw materials varies considerably, but translates into a relatively small difference when converted into a silver equivalent. The broad 1:200 ratio of metallic scale armour to leather (or more likely rawhide) armour noted in the list of booty seized at the Battle of Megiddo (see Chapter 2.2.2.4 and 5.3.1), suggests two possibilities: 1) the use of metallic armour was strictly a mark of status, or 2) leather armour was favoured due to the decreased weight, leaving the metallic armour to the officers as a status symbol.

With a different analysis of the cost of armour, a different solution presents itself. If the cost of the armour in *Papyrus Mallet* refers strictly to the cost of the raw materials and has no reference to the cost of labour, the results can be justified strictly in economic terms through the following three examples (the examples are adjusted to achieve a 5 *deben* cost for the rawhide armour):

4) Raw materials for a sleeveless coat of rawhide scale armour (Ventzke's *Type A*)

1 rawhide sheep or goat skin	2 *deben* of bronze (cost)
½ tanned sheep or goat skin	1 *deben* (or more) of bronze
3 *mrw / pry* lengths of cloth (linen)	3 d*eben* of bronze (cost)
Fibre cordage and leather lacing	negligible
Total cost of materials	**5 *deben* of bronze ≈ 0.050 *deben* of silver**

5) Raw materials for a sleeveless coat of bronze scale armour (Ventzke's *Type A*)

Bronze for necessary # of scales	81.8 *deben* of bronze (weight)
½ tanned sheep or goat skin	1 *deben* (or more) of bronze
3 *mrw / pry* lengths of cloth (linen)	3 d*eben* of bronze (cost)
Fibre cordage and leather lacing	negligible
Total cost of materials	**85.8 *deben* of bronze ≈ 0.858 *deben* of silver**

6) Raw materials for a full-length coat of bronze scale armour (Ventzke's *Type D*)
(note: more leather and linen would be needed for the lining of the armour)

Bronze for necessary # of scales	293 *deben* of bronze (weight)
1 tanned sheep or goat skin	2 *deben* (or more) of bronze
6 *mrw* / *pry* lengths of cloth (linen)	6 *deben* of bronze (cost)
Fibre cordage and leather lacing	negligible
Total cost of materials	**301 *deben* of bronze ≈ 3.010 *deben* of silver**

With this second set of calculations the cost of the materials becomes obvious. Based strictly on economics the ratio in cost of similar rawhide and bronze coats of scale armour is 1 to 17.2, suggesting that the more costly metallic coats of scale armour would be more likely to have been reserved for those in greatest need of superior protection or those of greater social rank. Furthermore, regardless of the material, the longer and heavier the coat of armour, the greater the cost. With the second set of examples (nos. 4, 5, and 6 above), the cost of labour is not taken into consideration. It must be noted that the longer and more elaborate the armour, the greater the cost of labour would have been.

The cost of a chariot appears in *Papyrus Anastasi* III 6, 7-8 and dates to the reign of Merneptah [c. 1212 - 1202 BC] or earlier, as there is a possibility that this papyrus is a copy of an older original. This papyrus describes the life of an army officer and includes reference to his purchase of a chariot. The officer purchases the chariot pole for 3 *deben* and the chariot body for 5 *deben* (Janssen 1975: 329). There is no reference as to whether the 8 *deben* total cost is of bronze or silver, it is probable that silver is more likely than bronze due to the large difference between these "prices". Furthermore, he suggests that 3 *deben* for a wooden pole is rather high (Janssen 1975: 329), though it may well have been an imported length of wood as a fairly long piece would be needed for a chariot pole.

The chariot pole could indeed cost 3 *deben* of silver if it were to include the yoke and associated harness; things that would be essential in the use of the chariot. The total cost of the chariot (8 *deben*), including the pole, translates to 86.7 shekels (728 grams) using the figure that one shekel equals 8.4 grams, one *deben* equals 91 grams. The prices are converted to shekels to fit better with Heltzer's (1978) text on the prices of goods and commodities. Given the 8 *deben* price, and the fact that it is not a royal chariot, the chariot is probably not as highly decorated as the fancier chariots in the tomb of Tutʿ Ankhamūn, and is likely a more functional vehicle similar to Chariot *A4* from the tomb (see Littauer and Crouwel 1985).

One critical factor in chariotry which is also mentioned in the ancient texts are the horses necessary to pull the chariots. The charioteers of Nuzi are occasionally noted as "needing horses" (HSS XV 19, 27, 40, 46), and wealthy members of society are thought to have bred horses (see HSS XV 35, 36, 47, 100, 145) (Kendall 1974: 130), although it is unclear if these horses were intended for sale to the state or for personal use. The last lines of Nuzi text HSS XV 27 notes "A total of 230 brothers; a total of 157 [+ x] charioteers, the "heads" that are not going; 143 men have no horses. Tablet of the right (flank)." This shortage of horses for 143 men equates to approximately 143 horses, as there are two men to a chariot, so too are there 2 horses. There is no explanation in the text for this shortage of horses, but it could represent the losses after a particularly harsh battle. Shortages of horses in wartime would have been a serious problem as it would have rendered many chariots unusable (Kendall 1974: 130). Losses in battle, as horses were particularly susceptible, may have had a serious affect on the chariot forces available for a given military action. Numerous instances occur in the Nuzi texts (see Kendall 1974) where soldiers are noted as having deficient equipment (i.e. armour, weaponry, chariotry) and did not "...go to Zizza" (a town on the Nuzi frontier). The lack of horses, and other equipment, could have made a serious impact upon the Arrapḫian forces.

Nuzi text HSS XV 44:13 states that there were 489 charioteers released to their homes from a single *ḫalsu* district (Kendall 1974: 131). This would imply a force of approximately 244 chariot teams which would require 244 chariots and at least 488 horses, not including those which were probably held in reserve, which was often one extra horse per chariot (Littauer 1972: 153). Given that this is from one single district (Nuzi having an unknown number of districts), it is possible that Nuzi may have had extremely large numbers of chariots, and therefore a corresponding numbers of horses. This large number of horses would have been a tremendous economic drain on the palace economy as the cost of horses in the Late Bronze Age Ugarit ranged from 30 to 200 shekels of silver for each horse (Heltzer 1978: 21-22). Horses are shown by Heltzer (1978: 100, 106) to have been least expensive in the Hittite empire with similar prices at Nuzi, but were almost five times as costly at Ugarit, probably due to their having been imported.

A similar situation is likely to have existed in Egypt where the horses would most often have also been imported, and perhaps also due to a lack of suitable pasture for grazing. It is also quite likely that the wealthy elite soldiers, particularly the nobility, made use of finer and faster horses that the "regular" charioteers did.

The total cost of chariotry, horses, equestrian equipment such as tack, and the overall maintenance of these items was a responsibility that only the wealth of a palace could afford (Schulman 1963: 95, Yadin 1963: 284, see also Drews 1993: 112), not to mention the composite bows and armour. The panoply of the chariot warriors was a costly exercise in conspicuous consumption, which was certainly one element in outfitting the elite soldiers, however it must also have been militarily effective otherwise the archaeological remains of this equipment would probably be even more rare than they are.

5.4) Status Depicted Through Burial Goods

The presence of armour scales and archery tackle in burials may indicate that the Middle Bronze Age concept of "warrior burials" did continue into the Late Bronze Age in an altered fashion. Philip (1989: 150) notes that the Near Eastern warrior burials in the Middle Bronze Age were characterized by the presence of a set of weaponry composed of an axe, a dagger, and one or more spearheads. It has been suggested that the concept of warrior burials declined with the beginning of the Late Bronze Age, as this axe/dagger/spear set vanishes from the burial goods (Philip 1989, 1995: 145-146, 153, Gonen 1992). With the changes in military strategy and equipment, it is not unlikely that there were changes in the manner in which the elite warriors were buried. Furthermore, the manner in which the artefacts in warrior burials changed from the Middle to Late Bronze Ages is not necessarily the same as for other artefacts (see Philip 1989: 149), for instance, ceramic vessel forms. Weaponry may have also been associated with the concept of a "warrior's greatness", and therefore been taken as an acceptable general item denoting high status (Philip 1989: 150-151). However, as has been noted (Philip 1995: 153), the warrior's equipment was associated with the power to take tribute and lives and thereby acquire wealth and reputation. There must have been some actual, physical, connection between the military equipment and status. The military equipment interred with the dead must have been visibly used in life to have such a grand meaning in the afterlife.

The elite warriors of the Late Bronze Age are associated primarily with chariot warfare, which is in contrast with the hand-to-hand combat which characterized the warfare of the Middle Bronze Age. This change also included a change in the type of items used to indicate elevated status. The mobile, chariot-borne style of fighting employed by the new *maryannu* elite soldiers likely relegated hand-to-hand combat to the lower classes along with the weaponry associated with that approach (Philip 1995: 153-154). The military equipment used by the Late Bronze Age chariot forces also provided a fine basis for embellishment and the display of wealth, again leaving the infantry weaponry, and infantry warfare in general, to the lower classes. If the concept of warrior burials continues into the Late Bronze Age, the shift in equipment used by the elite would likely cause a shift in the objects with which they were buried. It is also unlikely that this shift was identical across the entire Near East.

It is probable that the burials of Late Bronze Age elite soldiers would include military items linked with their social status and military rank rather than those associated with the lower classes, thereby causing a decline in the inclusion of infantry weaponry in the early Late Bronze Age burials of elite warriors. The primary reason why the entire custom of warrior burials appears to decline is that the majority of the military equipment which an elite Late Bronze Age warrior would be buried with would have been organic. Coats of organic (rawhide or leather) scale armour, horn-wood-sinew composite bows, leather quivers, and wooden arrowshafts would all be likely to decompose over time. The only indicator that might survive would be groups of metal arrowheads, lying together (often fused together) as though they had been in a quiver.

There is little evidence outside Egypt for burials which included chariots (i.e. the six chariots in the 18th Dynasty tomb of TutʿAnkhamūn, and remains of chariots and harness in the royal tombs of Amenophis II, Thutmosis IV, and Amenophis III, as well as the non-royal tomb of Yuia and Tuia [Littauer and Crouwel 1985: 98]). These would be impractical item to bury due to their large size and cost. As such, they do not often appear in the Late Bronze Age Near Eastern burials. This leaves other items of the chariotry which include the archery tackle and the armour. The scale body armour only appears in a burial contexts in a very few cases, primarily the armour found at Kāmid el-Lōz (see Chapter 2.3.1). The inclusion of organic armour in burials is proven by the coat of rawhide scale armour found in the tomb of Tutʿankhamūn. It must, however, be noted that this is something of an anomaly, preserved by the conditions in the tomb. The inclusion of a biologically active organic artefact such as a coat of rawhide armour (see Appendix 2) in a Late Bronze Age earthen burial would almost certainly leave little trace. The presence of metallic armour scales, although rare, is occasionally noted, and may indicate that the interred was of exceptionally high status. It is also possible that entire coats of metallic armour were rarely, if ever, placed into the tombs due to their exceptionally high value, a few scales sufficing as a placebo.

The composite bows which are often associated with the elite chariot warriors may also have been included in some burials. Aside from the gold-embellished examples from TutʿAnkhamūn's tomb, the composite bows are entirely organic, and are only preserved in exceptional circumstances (such as a bow from a late 17th/early 18th dynasty tomb near the Valley Temple of Hatshepsut, and another from grave pit 1013 in the Sankhkare Cemetery in the tomb of the warrior Ahmose Penhat [c. 1524-1518 BC] - see McLeod 1962: 15-17 for these and other examples)), thus disappearing in most instances. The organic arrow shafts and fletching, as well as the quivers, would also decompose, leaving only the bronze arrowheads which are occasionally found clumped together in the tomb chambers (see Gonen 1992: 67). Thus, the only item which may indicate a Late Bronze Age warrior burial may be the clumped arrowheads.

As the state owned the vast majority of the military equipment, items such as chariots, bows, and armour were probably not often available for inclusion in warrior burials, especially due to their high cost. Only the highest of the high-status elite could afford to purchase and then dispose of such equipment in burials. Two examples are the tomb of TutʿAnkhamūn and the rich burial at Kāmid el-Lōz (both discussed in Chapter 2). Due to this, armour (even the organic armour which may disappear due to decay), may not have been often included. Archery tackle, as the least costly element of the tripartite system, would have been the most likely to be included in the burials. The presence of arrowheads may indicate the inclusion of archery tackle (bows, arrows, and quivers) as an indication of a "warrior burial", and may have served as a form of indicator that the interred had been an elite warrior. While the axes, daggers, and spearheads present in Middle Bronze Age warrior burials were not inexpensive items, the manufacture of these items was not as time consuming, and therefore not as costly, as the Late Bronze Age armour, composite bows, or chariot components. This may be another reason why the axes, daggers, and spears were more likely to have been included in Middle Bronze Age burials while quantities of weaponry were not often included in Late Bronze Age burials.

Groups of fused arrowheads, possibly the remaining inorganic contents of a quiver, are not especially common in Late Bronze Age burials. Examples do exist, however, particularly from Cave 216 at Lachish, the "Governor's Tomb" at Tell el-ʿAjjul, and at the Persian Garden near Accho. Twenty-two arrowheads were found in a cluster in Cave 216 at Lachish, dating to c.1450-1300 BC (Gonen 1992: 67). At Tell el-ʿAjjul, two examples of clusters of arrowheads were found; in Tomb 419 (the Governor's Tomb) 35 arrowheads were found in association with an inscribed gold ring bearing TutʿAnkhamūn's name [c. 1334-1325 BC] , and a group of 26 arrowheads were found in Tomb 1037 which are of 18th dynasty date (Gonen 1992: 80, 82). The third major example of clusters of fused arrowheads comes from the Persian Gardens north of Accho, where an unidentified number of groups of arrowheads and spearheads (totalling of 62 in all) were found in an early 14th century context (Gonen 1992: 84). Other examples may exist, such as at Tel Jedur where 17 arrowheads were found in one context (Gonen 1992: 66), but there is no specific information as to whether or not they were fused together.

The possibility of groups of arrowheads indicating the presence of leather armour leads to a necessary assessment of the general value of armour in the Late Bronze Age. Coats of scale armour, wholly metallic, composite, or wholly organic, would be a costly item to remove from circulation by placing it into a tomb. It would effectively involve high-level conspicuous consumption on the part of the deceased or their family (Gonen 1992: 15-16). As has been shown above, the cost of the armour was significant, and the less valuable the item, the more likely it was to be included amongst the burial goods, provided that it remained within the social guidelines. It is also difficult to assess the numbers of coats of organic armour that may have been included in the burials due to the perishable nature of the material.

Sherratt's (1998: 295) concept of "placebo goods" being interred with the deceased in place of more valuable "non-placebo" goods may hold true to a certain extent for armour. The relative rarity of bronze armour scales in graves all across the Near East adequately suggests that metallic armour was not a common grave item. Depending upon the level which the ancient military organizations made use of body armour, it may not commonly have been economically feasible to include an item such as metallic scale armour. A "placebo" coat of leather scale armour *may* have been sufficient to see the deceased into the next life as they were similar in most respects to the metallic or composite coats and almost certainly in common use alongside them. Simply put, it may not have been necessary to be buried with a metallic coat of armour as an organic coat would suffice. This, however, does not take into account the distinct possibility of a social stigma which may have surrounded the use (and depiction) of organic armour (as noted above). Should this hypothesis that organic armour was a suitable "placebo grave good" be true, then it further decreases the chance of finding metallic armour scales in burials in future excavations. The generally low numbers of metallic scales found within the few Late Bronze Age burials in which they exist (Tel el-Fara'h South, Gezer, and possibly Boğazköy: see the relevant entries in the database) may also suggest that a few metallic armour scales may have served as a substitute for an entire coat.

It is difficult to glean much information from the Late Bronze Age burials which include scale armour. Re-use of the burial for multiple interments would almost certainly disturb the context, and certainly with multiple interments, it may be difficult to establish which burial was originally associated with the scale armour. Looting, for weaponry or just for metal and other goods to recycle, would also disturb the context. It would also likely remove quite a lot of the relevant material, thus further skewing the data (see Gonen 1992: 6). A coat of bronze scale armour was, as has been demonstrated in this thesis, a highly valuable item, particularly so due to the high degree of workmanship involved. It would also represent a tremendous find for tomb raiders as an item which is already broken down into parts suitable for re-melting. Looting could also re-introduce weaponry into a use-life, especially from a recent burial which contained types of weapons still in active use. A recent elite burial, particularly one with a large quantity of metal goods, would probably be well known, and with the collapse of the Late Bronze Age palace systems around 1200 BC and the resulting fall of the social systems to which the dead had belonged, the tombs were ripe for the picking.

The similarity of the form (but not the size) of the bronze armour scales across the Late Bronze Age Near East, as noted in Chapter 4, may have a parallel with the axes and daggers included in the Middle Bronze Age warrior burials. Philip (1989: 152) notes that there is a remarkable degree of physical similarity amongst the axes and daggers included in the warrior burials all across the Near East, a similarity which exists despite notable differences in other artefacts such as the ceramics. Such similarities, as Philip (1995: 140-141) notes for the Middle Bronze Age axe-and-dagger combinations, are unlikely to occur by chance alone. One explanation is that these weapons symbolised a set of pan-Near-Eastern concepts connected with high social and military status (Philip 1989: 152, 156). It is also possible that the sets of daggers and axes included in the Middle Bronze Age warrior burials may not represent the actual weaponry used at that time (Philip 1989: 155), which is again parallelled by the fact that scale body armour was probably not in common use in the Late Bronze Age, even though it was associated with the high status elite charioteers.

5.5) Late Bronze Age elite control of goods, trade, and manufacturing

In a redistributive economic system, the state pulls in resources from the territories that it controls and redistributes them as it sees fit (Liverani 1990: 23) perhaps to alleviate stress caused by (i.e.) famine (Sherratt and Sherratt 1991: 353) or war. In the production of military equipment in Arrapḫa (see Kendall 1974) and particularly at Ugarit (see Heltzer 1976, 1982, Gordon 1949) the military equipment was produced by the *bnš mlk* corvée labour and through the *ilku* / *iškaru* "required" labour of the lower social classes. In fact, much of the *bnš mlk* produce, not only the military equipment, was intended for military consumption. Whether it was in the production of food for a military campaign or the production of military equipment. In one form or another, most of the people of Ugarit must have been involved with military production at some point.

In Ugarit, the military primarily "lived off the land" during campaigns, taking what was needed where it was to be found. However, there is mention in "The Legend of King Keret" of a quartermaster taking along large amounts of supplies, possibly sufficient for six months in the field (Gordon 1949: 124-125, Ginsberg 1946: 15 [lines 83-84], 18 [lines 174-175]). Such quantities of supplies almost certainly included extra weaponry, chariot parts, and perhaps also included armour. Stockpiles of equipment must have been prepared during times of peace, ready for use should Ugarit have embarked upon a military campaign. As Heltzer (1976: 21, 35) notes, the governing body at Ugarit required food and equipment from each of the villages as taxes which were supplied to the palace and redistributed as necessary. The towns in Ugarit, rather than individuals, were required to meet quotas as they were considered a single body with collective responsibilities, and each town may have been required to produce goods suited to its environment and the experience and training of its craftsmen.

The manufacture and distribution of various items of military equipment seems to have been strictly controlled by the state. The palace armouries at Nuzi were in control of virtually all forms of military equipment, to the point of there being specific individuals (*šâkin bîti*) whose task was to distribute and record the transactions where chariots and other equipment were *given to those authorized in their use*. This suggests that there was a system whereby individuals must have been recognized either by their personal identity by the individuals dispensing the equipment, or their names were fully recorded in some readily accessible form. This would have allowed individual use of military equipment to be monitored (at least to a degree) by an official section of the governing body. This would also have helped to prevent "controlled" military equipment from filtering down the social ranks and into the hands of the people outside control of the centre. Furthermore, the control that the governing bodies had over the production and distribution of weaponry was, in itself, a distinct form of power (Philip 1989: 158).

The manufacture and shipment of the military equipment in particular from the rural population of Ugarit to the palace armouries would have allowed the lower classes (Sherratt's (1998: 307) "peripheral peoples") to acquire in-depth knowledge of the manufacture of the military equipment used by the state, assuming of course, that they had not gained this knowledge from having been conscripted into military service. This knowledge base, in turn, would probably have allowed the lower class peoples to construct their own equipment given that they had the raw material to work with. In such an instance, the peripheral peoples would either have had to manufacture their own equipment in the styles used by the state, a form of the "placebo goods" suggested by Sherratt (1998: 295), a task that may not have been practical (i.e. chariotry), or they had to develop their own styles of equipment which were better suited to their level of technological ability, such as the rawhide "Sea Peoples" armour described in Appendix 1. The lack of raw materials generally controlled by the state, as will be shown below, would also prompt the development of new ideas. The phrase "*necessity is the mother of invention*" is appropriate.

Heltzer (1982: 99) notes:

> "We see that the textile workers, metallurgists, shipwrights, cartwrights, etc. had to be provided with raw materials for further processing. The same thing could not always be said about the potters and house builders, etc. for the raw materials used in the exercise of their professions was always easily available."

Essentially, those materials which were not controlled by the state could be used without constraint. Individuals seeking to provide some form of defensive armour would look to the materials available and form a solution suitable to both the level of available technology and the type of available material. The rawhide armour discussed in Appendix 1 (see also below) is an example of what might result from the peripheral non-elites developing their own military equipment.

The artisans of Ugarit had no materials of their own, having been supplied by the state, and were processing large quantities of metals including copper, bronze and silver (Heltzer 1982: 100, 1978: 79). This system would partially stop the flow of high-status goods down through the social ranks (see Sherratt 1998: 295). Certain amounts of (i.e. metallic) goods destined for non-elite consumption were likely formed from small amounts of hoarded scrap metal, although even recycled metal was often controlled by the state. Scrap metal was probably collected throughout the Eastern Mediterranean and traded widely, sometimes undermining the elite control of access to metals (Sherratt 1998: 299, Knapp, Muhly, and Muhly 1988). Although it is a very tentative comparison to Ugarit, scrap metal was controlled in New Kingdom Egypt as is demonstrated in the bundle of scrap metal found at Lisht which was wrapped in a linen cloth, and sealed with string and a clay seal bearing the pre-nomen of TutʿAnkhamūn (Arnold 1988: 101, 104, Hayes 1934: 8). The contents were primarily damaged metal vessels, worn and damaged tools, and notably, two copper-alloy armour scales (see database entries *Lisht 1* and *Lisht 2*). The fact that the bundle was sealed with a royal cartouche suggests that there was an organized program of reclamation of metals in New Kingdom Egypt. Again, this is an indication of the elite control of socially valuable goods directed to maintain the *status quo*. With the increase of non-elite traders and merchants, the trade of scrap metals would gradually serve to subvert elite control rather than bolster it as their (the elite's) control of the materials began to decline.

Recycling of damaged equipment, particularly metallic equipment, was highly probable. On a coat of armour, the damaged metal scales could easily be removed and re-melted and thereby be suitable for casting into most any other artefact. If the coat of armour only needed minor repairs, a few new scales could easily be put into place, thus rendering the armour serviceable. In the case of a heavily damaged coat of armour, the useable scales could be removed and held in reserve to repair other coats, or combined with other new or salvaged scales to be formed into a new coat. At Lisht, two copper-alloy armour scales were found in the basket of damaged metal goods as noted above (Arnold 1988: 101, 104, Hayes 1934: 8). Textual evidence shows that at Nuzi damaged equipment was given to an individual termed a *urultannu*, who is thought to be an official or craftsman. For example, text HSS XV 2:20f is a list of equipment that was given to the *urultannu* Wantia, son of Eḫlipapu (Kendall 1974: 170). This implies that there was an organized method of dealing with damaged equipment, and, as noted elsewhere in this chapter, damaged or missing equipment is often noted in the Nuzi military texts, and occasionally in the Ugaritic texts (see Heltzer 1982: 87).

Many artisans were bound to the palace as *bnš mlk* servants of the palace, and as such were supplied with their materials (Heltzer 1982). It is uncertain if there were artisans outside the palace structure, and if so in what manner they received the materials with which they worked. Most craftsmen, excepting such as the cartwrights (and possibly chariot builders) were not located in one distinct area or palace workshop (Heltzer 1982 100-101), but rather were spread throughout the territory of Ugarit. It is possible that the relatively small size of the territory controlled by Ugarit (as compared to Mitanni and the Hittite empire) allowed the production of many goods to be decentralized as the distances travelled by artisans, craftsmen, and officials were (relatively) close. This too would allow the palace to monitor the use and distribution of illicit elite goods, should they have been produced. Furthermore, the close proximity of most of the Ugaritic villages and towns would have allowed easier trade to and from the capital as well as allow the *bnš mlk* individuals and others to remain in their villages whilst conducting their *ilku* duties.

At Ugarit, text KTU 4.261,1 is titled "inventory of the tribute of the smiths". This text notes 19 smiths from three villages by name and the amount of metal goods they were to deliver to (presumably) the state. The smiths were each required to deliver between 500 and 2,000 shekels (4.2 to 16.8 kg) of finished metal goods, possibly as a professional tax or part of the tribute to be sent to the Hittite king (Heltzer 1982: 91). Text KTU 4.31 notes that the coppersmiths received 8 talents and 1,200 shekels (a total of 25,200 shekels = 211.7 kg) of copper "...for the tribute (to be paid) by the smiths..." (Heltzer 1982: 93), and is similar to several other texts (texts KTU 4.272 and KTU 4.377 [Heltzer 1982: 93-94]). This suggests that the smiths were provided with the raw materials to make a variety of goods which they were required to deliver to the state upon completion as a form of tax on their profession. It also served to allow the state to monitor the amount of weaponry held by the lower classes, as the quantity of metal issued was known, as was the weight of the finished goods; the craftsmen would have probably been held accountable for "missing" quantities of metal. Essentially, it was the labour and individual abilities that were taxed, as they were supplied with the necessary materials by the state, but also a means of controlling the goods possessed by the lower classes, including military equipment. By leaving the craftspeople in the villages, supplying them the raw materials, and requiring goods from them as taxation, the ruling elite of Ugarit could obtain the items they desired without the expense of specialist palace workshops, and still be able to exercise control. This system of dispersed production was viable in Ugarit as the polity was geographically much more compact than states such as the Hittite empire, Egypt, or Nuzi.

The Late Bronze Age was the peak of circulation of specialist techniques, designs, manufactured goods and precious materials, with great emphasis placed on goods made in foreign lands and in foreign styles (Liverani 1990: 14, 227). However, the military specialists were carefully controlled by the state and bound to them (Zaccagnini 1983: 245). Materials such as bronze and other metals possessed a form of culturally constructed power derived from the elite control, and this increased the desirability of these materials at lower social levels. The elite control was conducted primarily to prevent these materials from becoming devalued through seepage "down" the social strata and "across" to other elite groups (Sherratt 1998: 294-295). The diversification of the production of goods, both in the regions from which they came and in the form of the items themselves, allowed the elite sectors of society to maintain the prime value of the controlled materials by continually changing the form and style of the objects. It must be noted here, however, that this does not seem to be the case with scale body armour. This process afforded the objects primarily a "value added" status whereby the social status was increased. In this system raw materials were shipped from the country of origin out to a manufacturer or artisan in a foreign region to be worked, and shipped back again all so that the elite could acquire items which could not easily be acquired by the lower classes or by other elites (Sherratt 1998: 295). As such, this conspicuous consumption played a considerable role in the maintenance of social status.

The movement of lower-class goods through decentralized channels (Sherratt 1998: 196) can be equated to a "grey market"; the trade and exchange once a largely exclusive part of the elite classes was shifting to affluent merchants and itinerant traders who seem to have shifted considerable quantities of non-elite and "placebo" goods. This lower-class trade existed on a level which the elite were sure to have noticed, but were relatively powerless to contest. This "grey market" trading process was not illegal, but did remove some of the social and economic power from the elite. As such, the elite classes of society had to rely on exchanges of goods specific to their class, and often through official channels such as diplomatic gift exchanges and dowries. The governing bodies in the Near Eastern Bronze Age were able to gather information on the activities of the lower classes through their collection of accurate census information which was necessary for effective conscription (Sasson 1969: 9).

Given that the pan-Eastern Mediterranean non-elite trade appears to have begun to subvert the control of the palace-based governing bodies as the Late Bronze Age progressed, Sherratt (1998: 294) notes that the "Sea Peoples" may be seen as a structural phenomenon, a product of the natural evolution and expansion of international trade in the 2nd and 3rd millennia BC. This trade, initiated by the palace-based structures, carried with it the seeds of subversion of these same structures. As small-scale "sailor's trade" (Artzy 1998: 443) gradually increased, allowing individuals to amass wealth and thereby increase their own trading, the palace control decreased.

The economic system was forced to expand to include entirely "value-added" non-controlled goods, and was also forced to expand to prevent collapse. The decentralized system of trade and shipping that was developed to deal with the volume and diversity of products desired and in circulation lead to a decrease in the palace control of the economy (Sherratt 1998: 295).

Eventually the entrepreneurial non-elite traders were large enough to compete with the palaces, and even take palace commissions for trading and exchange ventures (Sherratt 1998: 295). With this structure in place, and the general decline in palatial control in the late 13th and 12th centuries BC, sailors and traders of the lower classes could freely be in contact with a potentially huge number of different cultures, and could pick and choose which ideas and products they wished to trade. As Karageorghis (1992: 79) notes, the changes in the political and economic structure did not take place all at once, nor were the changes uniform. This makes determining the shift in power and the rise and fall of various types of material culture, including military goods, difficult to pinpoint.

Information, military and otherwise, could also have proven lucrative. In an examination of this possibility, it is possible that the military technology (i.e. non-scale armour) as used by the "Sea Peoples" may have been an amalgam of ideas from any number of regions, thereby having no single identifiable origin, but originating nonetheless in a non-elite system. Local variations on a "theme" of military technology may be seen in the four types of Sea Peoples' armour described and depicted in Appendix 1.

The elite use of goods acquired through gift exchanges, such as the Amarna Dowry lists (noted below), would be a display to the non-elite sectors of society that the elite were in control of their territory, and possibly in control of other territories to some degree, by showing that they could obtain anything they wished (Liverani 1990: 47). Within the realm of the military, conspicuous consumption by those of high social status and possibly by the highly trained elite soldiers, may be reflected in the forms of military equipment that were used. Chariots, composite bows, and metallic scale body armour were perhaps equally indicative of both social rank and military prowess. For an archer to be effective - in any period of history - requires that he or she partakes of rigorous training and accumulates a significant amount of practical experience. The same may be said of any person deeply involved with equestrian pursuits. This, therefore, suggests that the charioteers of the Late Bronze Age were highly trained individuals. The presence of the wide range of weaponry associated with the chariots (i.e. at Nuzi) such as swords and javelins would further support this hypothesis, as each type of weaponry would require specific training. Social status, both acquired and birthright, would therefore be reflected in the equipment that a given individual was authorized to use. A point that must be noted is that even those born high on the social ladder must have undergone considerable training to be able to make effective use of equipment such as composite bows and chariots, and even then, these items were probably used only when necessary.

The scarcity of scale armour in the Late Bronze Age Near East can be demonstrated by comparing the relevant Ugaritic and Egyptian texts. As noted above (Heltzer 1982: 107-108), there were 1050 *mḏrġlm* guards at the same time as there were 230 *maryannu* charioteers. This figure is simplified from that which Heltzer (1982: 107-108) presents, as it does not take into account the number of other soldiers such as the infantry archers, the *šerdana*, and the *šanānu*. The ratio of *mḏrġlm* guards to *maryannu* charioteers is 4.6:1. The number of coats of armour and chariots seized by Thutmosis III from the Hittite armies at the Battle of Megiddo (see above) was as follows: 2 coats of bronze scale armour, 200 coats of leather scale armour, 924 chariots. This makes a ratio of 1 coat of bronze armour to 100 coats of leather armour, and a ratio of armour to chariots at 1:4.6. If there were 924 chariots at the Battle of Megiddo, there would have been approximately 1848 charioteers making use of them, and thus a ratio of approximately one coat of armour to every nine charioteers. If the Hittite ratio of infantry to chariotry was similar to that proposed by Heltzer (see above) of 1:4.6, then there may have been as many as 8,500 infantry soldiers, and thus, 1 armoured charioteer to every to every 51 soldiers (infantry and charioteers together). This shows that the use of armour was quite restricted. Furthermore, the fact that only two of these coats of armour were metallic, a ratio of one coat to every 5,174 soldiers, shows that there was actually very little metallic scale armour in use at any time. Therefore, the presence of small numbers of coats of metallic scale armour noted in the Nuzi military texts, and the inclusion of metallic armour in the Amarna dowries, are not at all out of place (see Kendall's 1974: 264 comment in Chapter 5.3.1).

5.5.1) Sea Peoples' Armour Hypotheses

The Sea People, according to Sherratt's (1998) hypothesis, represent the:

> "... replacement of [the] old centralized politico-economic orders by a decentralized economic system which steadily encroached from within or from the margins of the former [palace-centred political structure]." (Sherratt 1998: 307).

If one accepts Sherratt's (1998) hypothesis that the Sea Peoples were primarily groups of people who were living on the periphery of known societal groups, but who remained mostly anonymous in the ancient texts and depictions, interesting possibilities arise in the assessment of the military technology they are believed to have possessed, particularly the body armour. The "Sea Peoples" style of armour (see Appendix 1) is basically a relatively simple organic (leather or rawhide) corslet suitable for basic protection in battle. As the artistic depictions and texts of the ancient Near East are primarily concerned with the more elevated social sectors of society, it is not unreasonable to assume that the lowest orders would remain anonymous in all but the most significant events, such as Ramses III's battles against the Sea Peoples as shown on the reliefs of Medinet Habu.

With the collapse of the empires and palace-based economies at the end of the Late Bronze Age, the villages could still produce, but had little or no interests in common with what government remained (Kuhrt 1995: 393). The loss of the palaces affected the economics and production of the Late Bronze Age. This may have resulted in a greater degree of localism in some spheres, or a greater degree of uniformity in others, resulting in a simpler and less varied range of products. This likely reflected a less complexly stratified social order (Rutter 1992: 70). The Sea Peoples were a cosmopolitan, entrepreneurial, opportunistic, and perhaps slightly piratical group with merchant-like tendencies who may actually have benefited from the collapse of the palace structures and the subsequent massive decentralization of trading (Sherratt 1998: 301-302, 307).

Individuals and villages alike would have probably been freed from a system of palace-organized taxation and thereby had more of their own produce at their disposal. Furthermore, rather than participate in great expenditure in producing complex military equipment such as metallic scale armour, which appears to have been intended as much for display as protection, military equipment was most likely manufactured with a more utilitarian nature. Composite bows and chariots, both requiring specialist manufacturing techniques, were rarely made, the peoples relying on what equipment they had managed to acquire or had retained from their own military service. With reasonable care, many types of military equipment could have a relatively long use-life. Newly manufactured products, both military and non-military, may have been traded between villages through non-elite trading systems which had developed outside of the palace-based systems. The collapse of the palace-based economies, especially where military goods were being produced in the villages (such as in Ugarit), would not take the knowledge and ability to the manufacture of these items away from the lower classes. With regards to the manufacture of military equipment, only perhaps in the acquisition of raw materials did the lower classes suffer from the loss of the palaces.

The collapse of palace-based trading systems may also have determined the military equipment that could be manufactured. The loss of a trading system whereby exotic woods necessary for the production of composite bows and chariots, and perhaps tin for making bronze, would force the lower social levels, which were then faced with outfitting their own armies, to develop their own forms of equipment not requiring (formerly) elite-controlled goods. This may be part of the reason that the Sea Peoples depicted in the Medinet Habu reliefs do not make use of chariots or composite bows. The Sea People's style armour itself did not perform well against archery in the experimental work at H.M. Royal Armouries Museum (see Chapters 3.3 and 3.4), although the material from which the replica armour was made was incorrect (waxed leather instead of rawhide). This may, however, be associated with the fact that in the depictions of the Land and Naval Battles at Medinet Habu there are no Sea Peoples archers. This may be due to the Sea Peoples not having made use of archery tackle, or simply due to Egyptian artistic convention. It is also possible that the lack of Sea Peoples archers may indicate that the village craftsmen did not have the technological capability to manufacture composite bows, although this would not have prevented them from making simple all-wooden self bows. This lack of archery equipment may also, obversely, be reflected in the decreased effectiveness of the Sea Peoples' style of armour. If the soldiers who wore this type of armour did not often encounter archers, then the armour would not necessarily have been designed to protect against arrows. As has been discussed in Chapter 1.1, the decreased weight of this armour would allow an increase in mobility, thus providing some added protection to the soldiers simply by allowing them to more quickly move out of harm's way.

The peripheral peoples living on the edges of recognized society were certain to have witnessed the ostentatious displays of elite military conspicuous consumption in their use of the chariotry/composite archery/scale body armour tripartite system. Rather than scale up individual village production to manufacture scale armour of their own, perhaps an idea discouraged by the higher classes due to their desire to maintain their social elitism, the peripheral peoples may have developed their own forms of defensive armour. Instead of producing complex coats of armour which were the final product of multiple craftsmen (as took place at Nuzi, see above), a form of armour which could be made by village craftsmen was developed and took the form worn by the Sea Peoples soldiers depicted in Ramses III's battle reliefs at Medinet Habu. The lack of readily available large quantities of bronze may also have prompted innovation, forcing the non-elites to search for another material with suitable properties. Since organic (leather or rawhide) armour was already in use, this suitable material was already known. The ability to improvise is demonstrated by the form the Sea People's armour took, which is a notable departure from scale armour.

Furthermore, this "new society" of Sea Peoples may have had more flexible values than the conservative Late Bronze Age palace structures, and therefore a more reasonable attitude towards accepting new ideas and new types of goods, such as those with a foreign or amalgamated foreign/local origin. If the peripheral Sea Peoples were "invading" their own territory at the end of the Late Bronze Age, then the development of some form of military equipment would have been necessary. It could have initially been developed from a very wide range of scavenged equipment, or equipment brought by "sailor's trade" from all over the Eastern Mediterranean, and thus a wealth of different styles of equipment could be chosen for replication. Essentially, the best, but most economical, equipment from the Eastern Mediterranean was available to choose from.

Basic forms of defensive armour which did not rely on materials controlled by the elite, such as bronze, and which were used primarily by the lower classes may have had a degree of social stigma attached to them. As such, they would be less likely to be depicted in elite contexts within the contemporary artwork. The presence of leather armour in the Nuzi texts (see Chapter 2.2.1.4) suggests that "economical" forms of armour did see fairly widespread use in the 14th century BC at this locale. The practicality of the armour may have outweighed the social stigma where actual use was concerned, but probably failed to transcend the social boundaries, especially when depicted in artwork, and as such, there is little idea of what the armour may have looked like. The utilitarian style and structure of the Sea Peoples' style of armour (see Appendix 1) does not suggest that a display of social status was foremost in the minds of the wearers. What this form of armour does suggest is that it was produced to serve a purpose, and to serve that purpose at the lowest cost and with the simplest manufacturing techniques. However, as a wholly organic coat of armour would leave little or no trace in the archaeological record and is rarely to be found in the reliefs or documents of the Late Bronze Age, the concept becomes almost lost to modern archaeology, and hypotheses on its construction and effectiveness are just that; hypothetical.

Conclusions

It is evident from the analysis of the Late Bronze Age Near Eastern texts and depictions that the use of scale body armour was primarily the province of the wealthy elite, and within this group the soldiers who are best known to have used scale armour were the charioteers. The majority of the charioteers were connected in some manner with the elite, most probably having been born into their rank, with a few having achieved it through merit. It is evident, however, that the charioteers did not use armour in all of the tasks that might be expected of them. The records of the booty seized by Thutmosis III after the Battle of Megiddo shows that approximately only one in nine charioteers used armour in that battle. The specific military and social ranks of the charioteers from whom the 200 coats of leather armour were seized is not known; they could as easily have been commandos as commanders.

The texts from Ugarit and Nuzi show that the majority of soldiers were issued with equipment suited to the tasks they were to perform. It has been hypothesised above that some of the chariot troops served as elite commando forces, trained and equipped for almost any task they might be required to perform. If a squadron or battalion began to fail in battle, a unit of heavily armed and armoured charioteers may have been called forward to assist, racing into battle with the best equipment available to assist their flagging troops. Although the cost of their equipment was quite high, the possibility of the loss of a few chariots and their associated men and equipment would certainly be less than the cost of the loss of the whole battle. Other charioteers may have served as mobile archers, delivering their arrows into battle as necessary. Yet another group of charioteers, or perhaps all of them, may have served to chase down the fleeing enemy, turning a defeat into a total rout. Regardless, the costly equipment was not wasted, but rather its use was calculated against the possibility of its loss. Essentially, it was used in the most cost-effective manner; armour was only issued as, and when, necessary.

One manner in which the overall cost to the palaces was reduced was in the use of composite armour. The Nuzi texts note a variety of types of armour which were made of a composite of both bronze and leather scales. For instance, a coat of armour could have bronze sleeves and a leather body, or a bronze back and a leather front. Another possibility was that some coats of composite armour were made with alternating leather and bronze scales (see Chapter 3.1.3.5). Either of these approaches would decrease the cost of manufacture and provide greater mobility to the soldiers, while sacrificing little protection. The composite armour tested in the experimental work conducted for this thesis (see Chapter 3) shows that composite scale armour provided as much protection as the entirely metallic armour did, but at a savings in weight of approximately 42 percent. A composite armour which was constructed such that metal scales were included to provide extra protection for the most vital parts of the torso (i.e. added metal scales covering the spine, kidneys, and sternum/chest), but with the remainder made of rawhide scales, could reduce the weight considerably, thus affording a compromise between protection and mobility. For other tasks, such as mobile archers who were not likely to engage in hand-to-hand combat, a coat of scale armour made entirely of an organic product (i.e. rawhide) may have been more suitable. It must not be forgotten that a coat of armour made entirely of bronze scales would be an impressive sight, although very heavy, and may have served mostly as a form of "dress armour" and therefore was more important as a display of wealth and social status than as a functional military item.

The inclusion of armour in Late Bronze Age burials is a difficult aspect to analyse. Except in rare circumstances such as the tomb of Tutʿ Ankhamūn, organic armour would be very unlikely to survive. The few instances where metallic scale armour does appear in burials suggests that the individual with whom it was interred was of exceptionally high status. The cost of procuring and maintaining a coat of scale armour was high enough that only a palace economy could support such an effort. As such, little scale body armour may have been available to soldiers for funerary use. The instances in which it does appear, such as at Kāmid el-Lōz, denotes that the individual with whom it was buried was either extremely wealthy or of exceptionally high status, and probably both. Late Bronze Age warrior burials may have occasionally contained a coat of organic scale armour in addition to the archery tackle, but as both are made of predominantly organic materials, they are unlikely to survive. Due to the high cost of any form of scale body armour, the archery tackle may have been the only item which was available for inclusion in most elite warrior burials. With all of the other items having been controlled by the state, the less costly the item of military equipment (given that it was socially acceptable), the more likely it would be available for funerary use. Perhaps the inclusion of archery tackle was sufficient to indicate a warrior burial, and the armour, which was not used by all of the elite soldiers all of the time, was deemed less than absolutely necessary.

With the appearance of the Sea Peoples as a discernable social group towards the end of the Late Bronze Age there came a change in military equipment and tactics. This change in equipment was based on the lack of the wealth caused by the loss of the palace economies. The loss of an economic stronghold forced the Sea Peoples to develop effective, but economical, military equipment which did not rely on specialist techniques of production or on specialist craftsmen. Items such as chariots and scale body armour, both of which were very costly and were the joint effort of multiple craftsmen, were not appropriate, or perhaps even impossible, for the level of production and technical skills of village craftsmen. Furthermore, there was probably less need for the display of social status within the non-elites than there had been within the former palace-controlled military hierarchy. The simpler construction of the equipment used by the Sea Peoples did not necessarily make them a less effective force, but required tactics which did not make use of costly equipment. The Sea Peoples-style rawhide armour was not as effective against archery as the scale armour (see Chapters 3.3 and 3.4), but it would have provided some protection, which was, of course, better than none at all. Again, a form of light armour would allow a compromise between protection and mobility.

Chapter 6

Discussion and Conclusions

Introduction

The past century of archaeological research into Late Bronze Age body armour has concluded the following: The armour was made of metal, contained armour scales of various sizes, and was used by charioteers. Little practical work has been done up to the present concerning the form, construction, and actual use of Late Bronze Age body armour. This thesis has been undertaken to correct some of the inaccuracies in the literature and to assess the role of body armour in society by looking at the materials and construction, its effectiveness, and the social aspects governing its use. The armour appears to have been most often used in a tripartite association with chariots and composite bows, again, the use of which was primarily the province of the elite. Due to the fact that there is no single location in the Late Bronze Age Middle East where artistic depictions of armour, textual accounts of its manufacture and use, and archaeological examples have all been found together, it has proven difficult to assess the manufacture and use of armour in any one location. Therefore, the material presented in this thesis has focussed more on the pan-Middle Eastern use of the armour, and it is fully acknowledged that there were almost certainly some regional differences in the construction of the armour and, in particular, some differences in the function of armour in the social spheres.

Metallic and organic coats of armour, and likely also composite amour, existed and were used by some of the military bodies of the Late Bronze Age. Their form, appearance, and perhaps some of their methods of use, can be found in a few of the contemporary texts and depictions from the Middle East. The effectiveness of the armour has been established by the experimental work presented in Chapter 3, and the analysis of the individual armour scales presented in Chapters 2 and 4 have suggested some possible methods of construction. Through an examination of the archaeological contexts in which armour scales have been found, and an examination of the texts, depictions, and possible methods of construction, it has been determined that the armour was almost entirely the province of the elite military personnel belonging to palace-economies. It is probable that different forms of armour were made and used as and where necessary by different forms of chariotry, based upon the tasks which the soldiers were to perform, and issued only to those whose tasks required extra protection.

Scale armour seems to appear "fully formed" in the Late Bronze Age which suggests that either experimentation occurred with organic materials first, or less likely that it was introduced from outside the Middle East. The origins of this style of armour are uncertain, but it would only take one example of useful technology to begin a technological "revolution". Even so, it seems that scale armour, as it was used in the Late Bronze Age Middle East, was used in relatively small amounts. There are numerous possible reasons for its scarcity, the foremost being the great cost of manufacture. Again, despite the fact that the armour was proven quite effective against archery (see Chapters 3.3 and 3.4), it remains quite rare in archaeological contexts. This fact suggests that the armour was relatively uncommon, was recycled, or was made primarily from organic materials which readily decompose.

The archaeological material fits well with the information in the contemporary texts. The texts from Nuzi, primarily a collection of palace inventories, suggest that body armour, along with chariots, were items generally associated with the elite. The relative value of these items is apparent from their specific mention in the inventories, particularly the coats of armour, several being mentioned with specific counts of the metallic scales (see Chapter 2.2.1.2). It is also apparent from these texts that not all the soldiers who made use of chariots also made use of armour. Furthermore, the Amarna dowry lists include a few coats of armour which initially appear conspicuous by their lack of precious materials. Upon consideration of their complexity and high cost of manufacture, their inclusion in these groups of valuable gifts is justified. An example of the value of even an organic coat of armour is the presence of the coat of rawhide scale amour in Tutʿ Ankhamūn's tomb, which suggests that the elite did not always make use of the more expensive metallic scale armour, even though it was available at the same time (i.e. the metal scales from Lisht which date to the reign Tutʿ Ankhamūn). Some form of symbolism may have been attached to scale armour due to its association primarily with elite sectors of society, and the metallic armour scales that have been found in Late Bronze Age sites are almost all from within high-status contexts, such as the burial at Kāmid el-Lōz, the tomb of Tutʿ Ankhamūn, and the elite houses of Nuzi.

6.1) Form, Structure, Materials and Construction of the armour

Scale body armour, as has been described in each of the chapters above, is a cloth or leather (possibly) coat covered in scales made of a hide product or of metal. The coats of armour varied in length from hip to mid-calf and were either short- or long-sleeved, with some perhaps being sleeveless. The scales ranged greatly in size, with the smallest (26mm x 9mm) being found in the armour from the tomb of TutʿAnkhamūn to the largest (119mm x 40mm) which were found at Malqata in Thebes. The size of the armour scales that appears in the Late Bronze Age Egyptian depictions would suggest enormous scales at least the size of those from Malqata, while the Nuzi texts are vague, referring only to "large" and "small" scales when scales of many different sizes were found in the excavations at that site. It is possible that the very large size of the scales depicted in the tombs of Paimosi and Kenamun were an artistic convention to simplify the painting for the artist and the viewer, as the depictions are quite simplistic and do not convey much information as to specifics of construction.

Archaeological evidence shows that copper, or a copper alloy, and rawhide were used for the manufacture of the armour scales. Furthermore, there are a few "experimental" armour scales from Pi-Ramesse made from bone, ivory and ceramic. The armour scales were laced together into rows (prior to being attached to the backing material) using either leather or linen laces. The only surviving laces are again found in the armour from TutʿAnkhamūn's tomb and these are made of tanned leather. The size and form of some of the lacing holes in the metallic scales (small round holes) suggests that heavy textile thread was used instead of leather. The backing material to which the rows of armour scales were fashioned was made of several layers of either linen or leather, with the only archaeological evidence being the linen in TutʿAnkhamūn's armour. Each coat of armour would have required the use of a selection of different types of scales, with each type being used in specific sections of the coat. This was done to provide better protection in some areas (i.e. larger scales covering the chest, abdomen and back) and to provide greater mobility in others (i.e. smaller scales covering the steeper curvature of the shoulders). Each of the different types of scales may also have used different patterns of lacing holes so as to provide different lacing patterns which may have made the armour more flexible. The organic (rawhide) coats of scale armour may have been strengthened in key areas (eg. sternum, spine, kidneys) with small numbers of metal scales, thus forming a composite coat of armour. It is not known what the ratio of leather/rawhide scales to bronze scales may have been, and entire coats of armour may have been deposited in the archaeological record with only the few metallic scales surviving.

Ventzke (1986: 169-173) and Hachmann (1983: 149) have both suggested different methods of construction which make use of greater numbers of armour scales than are suggested by Kendall (1974: 277-278) in his examination of the Nuzi texts. Table 1 suggests that from 679 (400 large scales and 279 small scales) to 1138 (598 large scales and 540 small scales) armour scales were used in the coats of armour noted in the Nuzi texts, while 1316 to 3303 scales would be used in the coats of armour constructed by the methods suggested by Ventzke (1986: 174). The differences here are due to the different sizes of the armour scales found at Kāmid el-Lōz versus Nuzi, with fewer of the larger scales from Nuzi being needed for the construction of a coat of armour. Furthermore, the different numbers of scales used in coats of armour as noted in the Nuzi texts likely also reflect the different styles of armour which were being made. The numbers of scales noted in the Nuzi texts may also only reflect the numbers of metallic scales used in composite organic/metallic coat. As such, the technology appears to have been fairly stable throughout the Late Bronze Age.

The perforated armour scales examined in this thesis have a length to width ratio of approximately 2.43:1. This ratio most likely arose through trial and error with the best ratio being based on the most effective balance between flexibility and protection. In time, this may also have become part of the standardised appearance of the armour. Given the range of lacing patterns identified in the armour from TutʿAnkhamūn's tomb, Boğazköy, Ugarit, Nuzi, and Kāmid el-Lōz it is certain that a broad variety of lacing patterns were employed in the construction of each coat of armour, and because this is so, it shows that the scale armour technology transcended the Late Bronze Age Near Eastern political boundaries. The fact that there *was* some scope for stylistic variation from region to region can be seen in the slight differences in the appearance of the armour scales found in the various archaeological sites.

Earlier examples such as the scales from Nuzi (dating to c. 1475-1450 BC) are quite similar to later forms such as database entries *Bogazkoy 82/214.1* to *Bogazkoy 82/214.54* (c. 1200 BC). The greatest factor in determining the shape of a given armour scale was the position in the armour in which it would be used. The overall size of the armour scales within a coat of armour would also be a factor of the intended "level of status" of the finished coat. The great amount of time needed to manufacture a coat of armour has been demonstrated in Chapter 3, with the manufacture of the replica scales, and the lacing of them to make a coat, taking the greatest amount of time. The greater the number of scales, the more time would be needed to manufacture a coat, with the result that the coat would have a higher intrinsic status. An example of this is the coat of rawhide armour found in the tomb of Tutʿankhamūn: a very large number of very small scales. The very large scales found at Malqata may have been an attempt to decrease the manufacturing time by making the largest scales possible whilst still maintaining some degree of flexibility. As noted above, the relatively small sample size, of which 83.2% are from four sites (Kāmid el-Lōz, Boğazköy, Ugarit, and Nuzi) restricts the hypotheses that can be made concerning both the overall structure of the armour and the regional and stylistic variations.

6.2) The Social Aspects

The form of the armour scales used throughout the Middle East did not change much over the course of the Late Bronze Age. One of the reasons why this is so may be that the armour, after having been proven effective, also acquired a symbolic role. The wide distribution of very similar armour across the Middle East shows that some symbolic association was attached to the armour, and that this symbolism remained relatively unchanged (as far as can be discerned) over the course of the Late Bronze Age. One method of distributing the technology of scale armour may have been due to captured goods after battle, or simple trade. A few armour scales (or perhaps even whole coats) could have been taken to Mycenae and Cyprus as curiosities, and a very few scales have been found there (one from Mycenae and three from Gastria-Alaas). As there was no known wide-spread use of scale armour in the Aegean, it is probable that the technology, although known, was not used. The similarity of scale armour across the Near East may also be partly due to the fact that coats of armour were sometimes given as gifts between members of the elite, and perhaps even due to travelling artisans.

As scale armour was associated primarily with the elite, it is probable that relatively few coats (compared to the numbers of soldiers) were ever manufactured or used. Composite coats and organic coats may have been more widely used than all-metallic coats, but would still have maintained *some* of the same status or symbolism. This would tend to stabilize the style and appearance of the armour much as it would any type of "uniform". There is also the possibility that, due to the weight, the heaviest coats of bronze armour listed in the Nuzi texts were intended more as "parade" armour rather than as fully functional military equipment (see Table 1). This may also be why such specific records and inventories were kept at the Nuzi armouries, with only the most valuable coats of parade armour being recorded. Kendall (1974: 320) notes that the term *tegipu*, sometimes associated with armour (i.e. Nuzi text HSS XV 3) meant "polished / gleaming / bright / finely wrought / beautiful and/or decorated". This further suggests that the armour described as such (*tegipu*) was parade-quality or "dress" armour.

Although there does not appear to have been any great differences in the overall type and form of scale armour, aside from overall length and the length of the sleeves, the slight differences may also be explained by the relative numbers of coats produced. The fact that metallic armour was produced in relatively small quantities in comparison with hide armour is suggested by the annals of Thutmosis III's victory at the Battle of Megiddo where he seized one coat of bronze armour from the Prince of Megiddo and 200 coats of leather armour from the Prince's army (Lichtheiem 1976: 33-34). With respect to this example it might be reasonable to hypothesise that the small numbers of coats containing metal scales were made to no particular specification, but rather to individual requirements or to requirements specific to particular uses, i.e. different styles of armour for different types of chariot warrior, based on the tasks they were to perform. The wide variety of sizes of metal armour scales may reflect this situation, with various sizes appearing in wide-ranging contexts. The similarity of armour may also be due to the fact that if relatively few coats of scale armour were ever made, there would have been no pressing need to develop different technical or regional styles. Furthermore, should the scale armour have had a strong symbolic role in the military aspects of society, there could have been some form of injunction against changes and severe alterations to the style.

The presence of body armour in the tomb of TutʿAnkhamūn and the burial chamber at Kāmid el-Lōz suggests that these items were considered fit to be buried with the highest ranking members of the elite, although the materials from which these coats of armour were made is notable. The quantity of armour from Kāmid el-Lōz (see Chapter 2.3.1.2) suggests that it was a composite bronze/organic coat, as there were far too few scales found to make a whole coat. Furthermore, the coat of armour from the tomb of Tutʿ Ankhamūn (see Chapter 2.3.3) is entirely organic where one might normally have expected a metallic coat given the opulence of the majority of the other associated artefacts. This suggests that the wealthiest of the elite did not necessarily use metallic armour, an hypothesis which is further strengthened by the inclusion of leather coats of armour in the Amarna Dowry lists (see Chapter 5.3.1). This hypothesis suggests that the perhaps the armour itself had a higher symbolic role than the material from which it was made. Philip (1989: 157 via Rosen 1984: 504) notes:

> "...metal does not uniformly replace other materials. The change depends very much on the context of use of the particular objects... Metal then, was considered a medium suitable for the carrying of symbolic messages by the fourth millennium, apparently prior to its widespread use in the production of weapons."

This suggests that the material from which body armour was made was not necessarily linked to its inherent symbolic status. In situations where armour may have been worn primarily for display lighter organic armour may have been more suitable, whereas when it was worn for protection, metallic or metal-reinforced armour may have been the better choice. The strictly economic analysis of the use of organic armour does not, however seem to hold with this hypothesis. The great cost of wholly metallic armour would suggest that it would be the better choice in situations of conspicuous consumption. Altogether, this rests on the non-quantifiable degree of symbolism embodied in the armour itself, and it is also possible that some of the specific aspects of the symbolism differed by regions.

The appearance and use of other types of armour, such as the Sea People's styles, may have been one result of the non-elites and peripheral peoples attempting to emulate the elites whilst not copying them outright (perhaps for the aforesaid reason of symbolism). It would not be difficult for non-elite soldiers to see the benefits of armour and devise a new, less costly style of their own. This emulation may also have occurred in conjunction with foreign military ideas, particularly if the ideas were cost-effective. Mercenaries may have brought the foreign military ideas, such as the Sea People's armour, to a region in much the same manner as it is believed that the chariot and composite bow were introduced to Egypt by the Hyksos. The mercenaries may have developed their own ideas which were then adopted by those they fought for or eventually by those they helped conquer. The Sea Peoples' style of armour, while not as effective against projectile weaponry as scale armour, may have afforded a balance between effectiveness and cost, and did not use materials controlled by the elite. Furthermore, with a collapse of the palace structures at the end of the Late Bronze Age there may have been a decline in availability of raw materials such as bronze, therefore further promoting the shift to alternative materials and simpler methods of construction. The collapse of the Late Bronze Age palaces would also have disrupted palace production of military items, thereby making the complex scale armour unavailable. The villages which survived the collapse of the Late Bronze Age palace structures would have needed to look to other methods and means to outfit their militias. Altogether, towards the end of the Late Bronze Age, the two different styles of armour may have reflected inhabitants of "parallel worlds": the Sea Peoples and soldiers of other peripheral peoples versus the elite palace-based military establishments.

6.3) The Armour in Use

As was noted in Chapter 1, a coat of armour is only useful if the protection it affords offsets the restricted mobility that comes with its use. It may be argued that different soldiers required different equipment for different tasks, as has been discussed in Chapter 5. The different equipment allocated to soldiers would be suited to the tasks they were to perform, and it is highly probable that those soldiers who did not need armour did not receive it. For instance, chariot archers whose task it was to send volleys of arrows into the advancing enemy ranks may have been able to do this from such a distance as would decrease the threat of injury, thus making armour unnecessary. The chariot soldiers whose task it was to race into the thick of the battle to provide quick support to flagging units of infantry soldiers, possibly fighting on foot themselves, may have had good cause to wear armour. These soldiers would not only have needed to care for their own lives, but also those of the chariot horses and perhaps even the chariot driver should he have been unarmoured. Furthermore, there is also some evidence for horse armour, which would again be a costly item which would have been deemed unnecessary if the horses were not being used in hazardous situations. Highly trained soldiers who had become accustomed to wearing the heavy scale armour may well have benefited a great deal from its use, their training serving to lessen the degree of decreased mobility.

The numbers of soldiers actually making use of armour in the 15th century BC may be seen in Thutmosis III's annals of the Battle of Megiddo. The pharaoh seized 924 chariots after the battle, but only 202 coats of armour, with only two of those coats being made of bronze (Lichtheiem 1976: 33-34, see also Chapters 2.2.2.4, 5.5 and 5.3.1). This suggests three possibilities: 1) there were different types of enemy chariot troops present at the Battle of Megiddo, some of whom did not use armour, 2) there were charioteers of different social status present at the battle, with only those of higher status using armour, or 3) a great many of the coats of armour were too badly damaged to take as booty. Given the suggestion in Chapters 5.3.1 and 5.5 that the scales from damaged coats of armour could be easily recycled, even a badly damaged coat would have been worth salvage, therefore making it unlikely that damaged coats of armour would be omitted from the lists of seized goods. As such, the use of armour is again linked to the individual status of the soldier and/or the task he was to perform.

The wide spatial distribution of armour scales suggests that knowledge, if not use, of scale body armour existed across the Middle East. The primary factor which governed the use of scale body armour was the presence of a palace economy and workshops. The manufacture of the body armour would require a bronze foundry, a tannery, textile workshops, and knowledgeable artisans and armourers. The diversification of labour in the manufacture of scale armour, which took individual skills into account, shows that scale armour was quite a complex item, each coat having been the product of several individuals (see Chapter 3.5). The grandeur and level of complexity of the scale body armour issued to the charioteers, as can be seen in the analysis of the Nuzi texts, is certainly a point which bears examining. Why this particular form of armour (numerous small scales) was used is uncertain, as the complexity of construction alone would likely decrease the numbers of coats of armour in use. There is an indefinable point, probably based in the prevalent social elitism of those in command of the military, which kept a useful item of military equipment from being used more widely.

The scale armour was unlikely to have been widely used due to its complexity and therefore is elevated cost. It must be noted that there is little evidence for the Late Bronze Age palace structures having experimented with different forms of body armour. The only definite example of this is the few ceramic, bone, and ivory armour scales found in the workshop context at Pi-Ramesse (see database items *Pi-Ramesse 1.1041, 2.1041, 82/0489, 86/0661, 87/0557b,* and *87/0814*). The origins of the concept of scale armour is unknown, however, it is reasonable to assume that the first experiments were probably conducted using organic materials which do not survive. It is possible that the impetus for innovation in body armour was at the directive of an elite body, thereby causing the prototype coats of armour to be suitable for elite consumption (i.e. made predominantly of metal scales), and therefore not the province of the non-elite soldiers.

The complexity of the armour does not rule out the possibility that a competent individual village craftsperson could have manufactured it, however the number of different components and the overall "cost" of the armour in effort and materials would perhaps make it a less appropriate non-elite style of defensive armour. Instead of spending a great deal of effort and material in armouring a small number of soldiers in scale armour, the villages could armour many more soldiers in a less costly (and albeit less effective) armour perhaps resembling the Sea People's styles. The manufacture of the replica sections of armour used in the experimental testing (see Chapter 3) provides strong evidence that the cost of providing all the charioteers of a given Late Bronze Age polity, much less all of the soldiers, with armour was prohibitive. As has been stressed above, the use of body armour was restricted only to situations where it was needed: essentially those situations where a soldier did not have a hand free to use a shield.

Overall, the use of armour in the Late Bronze Age Middle East was governed by economics. The high cost of materials and the high cost of production both preclude the use of scale body armour by the masses. Attempts to create forms of defensive armour were made by the peripheral non-elites with the "Sea Peoples" style rawhide body armour being the result. This fact also suggests that other technology, i.e. possibly iron technology, although known, was too expensive to gain widespread use. There is general recognition in the archaeological literature that palace-based economies were capable of producing and using vast quantities of goods of all types (e.g. pottery and metal goods). An examination of the military industry shows that it derived much of the goods it used through the same centres of production, often using the same craftsmen (see the *bnš mlk* in Chapters 5.1.3 and 5.5). An examination of the military industry by means of a particular type of artefact, in this case the use and production of body armour, may suggest that military production and provisioning was a more important aspect in society than has previously been recognized.

The Nuzi texts (see Chapter 5.2.1) occasionally mention that some charioteers owned their own chariots, and maintained the armour as a personal possession (see also Kendall 1974: 72). It is not unreasonable to suggest that some may have also owned their own arms and armour outright. This private ownership may also have served to increase the individual's status. Philip (1989: 161) notes that the benefits to the owners of high-status items (in his work specifically the ownership of weapons) involved setting an individual apart from the rest of the populace. As the weapons carry significant status and reflect male, warrior imagery and ideals, one gains from the debts incurred in procuring the weapon. Essentially, the cost of the weapon (and armour in the Late Bronze Age) "purchased" not only an effective item of military equipment, but also a level of social recognition which also included a set of warrior ideals. In the case of scale body armour, the item was of high-status not only because it was of complex construction (rather than made of precious materials), but also because it embodied the high-status warrior imagery of those associated with it. The fact that scale armour was also quite effective would also have enhanced the warrior imagery and ideals as it would afford the wearer extra protection in battle, and hence (perhaps) a longer life, which would lead to that individual accumulating status as an active and effective warrior.

6.4) Deposition of the Armour in the Archaeological Record

An active military presence in an area could result in small numbers of armour scales being deposited, for example, in battle. As has been demonstrated in the experimental work presented in Chapter 3, if a coat of armour is struck with a projectile, some of the laces holding the scales into rows may break, causing a few scales to fall away from the armour. While it is very possible that a few loose scales could be missed by individuals who collected booty after a battle, it is unlikely that a whole coat (probably still on a body) would be left behind. Only in unusual situations would armour remain in its primary depositional location as a result of battle. The fallen soldiers, and their armour, from Tel el-Fakhar (see Chapter 4.4.1.5) remained undisturbed until excavation strictly because the roof of the building had collapsed on the soldiers as they defended the building (Mahmoud 1970: 118), thus preserving the numbers of armour scales originally present and presumably their layout in the coats of armour. Unfortunately, further information on Tel el-Fakhar is unavailable at present.

Different taphonomic processes would account for the presence of armour scales in the various contexts presented in the catalogue/database (see Chapter 4). The presence of armour scales in a Temple context would suggest that the armour was either dedicated within the temple as a high-status offering, or perhaps was the result of battle or simply from the presence of temple guards (although this is less likely). The presence of armour in a Domestic Unit may suggest that the armour was issued military equipment retained as a personal possession or was privately owned. It may also, possibly, suggest that a battle had occurred within that context. The presence of armour in a Courtyard context may have been deposited by many factors. The courtyard may have been used as a training ground, may have had guards present, or perhaps was the site of a skirmish in a battle. The majority of the armour scales found in Courtyard contexts (see Chapter 4) are from Ugarit, and were likely not in a position of primary deposition as the site had been extensively looted. Armour scales found within a Public Building context also may have been the result of any number of taphonomic processes, based either on the type of building or on the activities of the individuals associated therewith. The presence of armour scales in a burial would definitely have been a factor of conspicuous consumption. The presence of armour scales in a context which can be identified as having been a manufacturing or workshop context would suggest that the armour was indeed being manufactured there, and possibly also stored there for short periods prior to transfer to the armoury.

In each of these situations, the generally low numbers of armour scales found suggests that the armour had value. The presence of armour scales as the result of guard units patrolling the area would probably have been the result of a single or few scales having fallen away from a coat of armour and lost. The deposition of armour as the result of battle, as described above, would be such that only a few stray scales might remain as the majority of the armour would likely be reclaimed and salvaged. Any location where armour was manufactured or stored was likely well known and would have been a prime target for looting upon the destruction of a city or town, again possibly leaving a very small number of armour scales, or none at all. Temples would also be a prime location for looting, and any coats of armour, weapons, and other portable metallic objects would likely be taken and re-used or re-cycled. The fact that no metallic armour scales appear in a Rubbish context suggests that the metal was too valuable to discard and was re-cycled. As organic material rarely survives in an archaeological context, few organic armour scales have survived to date, and none from rubbish deposits. Finally, the largest collections of armour have been found in Burial contexts (the Kamid el-Loz armour and the rawhide armour from Tutʿ Ankhamūn's tomb). This suggests that the most likely place in which one might find a complete coat of armour would be in a burial.

The dedication of armour in a temple suggests that the armour had a sociological value as well as a "monetary" value. If the armour was considered to have been an appropriate offering for the god or gods, then it must also have had value in the secular aspect of life. The cost incurred in producing the armour, as has been noted above, was considerable, thus making armour primarily the province of the wealthy elite. Should there have been an association with the warrior virtues, it stands to reason that a captured coat of armour may have been an appropriate dedicatory item in certain temples. Although both documents were written and compiled long after the Late Bronze Age, there are examples of the dedication of armour in both the Homeric and Old Testament stories, and it seems that arms and armour were considered appropriate offerings for the gods. As an example, at Byblos there are large groups of weapons, or hoards, believed to have been dedicated at the temple and buried nearby (see Philip 1988: 191-193; 1989). A possible example of military equipment being dedicated at a temple may be found in the Nuzi military texts in text JEN 533 (see Kendall 1974: 347) where four coats of armour and a selection of other military equipment (including horses, bows, and quivers) were given to Tarmia and Keltešup to take to the "City of Gods".

The presence of small numbers of armour scales in some burials and in temple contexts (i.e Boğazköy, Beth Shan, and Tell Dierʿ Alla) might suggest that it was not strictly necessary to deposit an entire coat of armour to gain the desired degree of prestige. A similar situation occurs in the Middle Bronze Age with the dedication of votive miniature weapons at Ugarit and miniature ceramic vessels at Nahariyah and Byblos (Philip 1988: 196). It must, however, be noted that these small groups of armour scales could also have been the metallic component of a composite metallic/organic coat, or a few scales remaining after looting.

The sociological value of arms and armour may also be one of the reasons that armour was not thrown away. Although there is no evidence to support the hypothesis, there may have been more to military equipment than just the component material, such as the "soul" attributed to the Japanese swords in the later medieval period. As such, one would not expect the items to be thrown away. The high symbolic value of coats of scale armour, and their association primarily with the wealthy elites, may have caused them to be of too great a financial value to dedicate in their entirety. If they were of such great value, a small votive offering of a few scales may have been suitable. Due to the great amount of effort involved in manufacturing a coat of armour with very small scales, a miniature coat of armour (like the miniature votive weapons mentioned above) would not be practical.

6.5) The experimental work

The experimental work presented in Chapter 3 was devised to establish whether or not a coat of scale armour was effective at protecting against an attack. Should the armour have proved ineffective, it would have been apparent that the armour was strictly an item of conspicuous consumption used by the military elite. A parade armour, in effect. As the armour *was* proved to be quite effective, even when made of different materials, it is certain that it was used in battle, even if only by those most in need or those of highest status. The experimental work has proved that the bronze armour and the composite bronze/rawhide armour were effective against all forms of arrowheads when tested at close range (7 metres) (see Tables 3a, 3b, and 3c). Although the rawhide armour was not as effective at this distance, providing only some protection against unsharpened bronze arrowheads and the ebony bodkin points, it would likely have been quite effective against all arrow types, including the sharp high tin-content arrowheads, at a greater distance, perhaps at more than 25 metres.

The replica coat of Sea Peoples' style armour was proved to be relatively ineffective at protecting against missiles at close range. It was however perhaps designed for protecting the soldier against blunt trauma rather than projectiles. This hypothesis is based on the lack of projectile weapons portrayed in the hands of the Sea Peoples soldiers in the Medinet Habu reliefs (which may be only a factor of Egyptian artistic convention). Although the replica coat of Sea Peoples' armour was not as effective as the replica sections of scale armour, it would have offered a great economic savings in materials and effort in construction while still providing some added protection for the soldiers. Scale body armour was, as has been noted above, quite effective, and this was probably widely recognized by un-armoured soldiers in the Late Bronze Age. The Sea Peoples style of armour would most likely have been within the manufacturing capabilities of a village craftsperson, and would not have required any elite-controlled materials in its manufacture, i.e. bronze. Both the Sea Peoples' armour and the rawhide scale armour would have provided some protection against archery at a distance, and at least some added protection at close-quarters against most other forms of weaponry. The development of organic armour such as the Sea People's styles was probably the result of this emulation combined with, perhaps, foreign military ideas.

The decision to test the armour against replica archery tackle was based on the hypothesis that the majority of the soldiers who would have made use of armour would have also made use of both chariots and archery, with the likelihood that all three were in use simultaneously. The sharp arrowheads used in the experimental work were made from a high tin-content gunmetal-bronze (which includes some 2% zinc; see Appendix 5) and were of greater hardness than the majority of the arrowheads in use in the Late Bronze Age. The use of the very hard, sharpened arrowheads was deemed appropriate as it allowed the armour to be tested to extremes. It was decided that the armour would not be tested proof against swords, spears, or other weapons due to the lack of information on the particular styles of fighting in the Late Bronze Age. The facts that only a high tin-content sharpened arrowhead could be almost "guaranteed" to pierce rawhide scale armour at close range, and the increased mobility afforded to the soldier wearing a rawhide coat, would have made this type of armour a highly effective form of protection for the chariotry forces. Furthermore, the fact that it is more difficult to hit a moving target than a stationary one would also have provided the driver and chariot warrior some added protection.

Conclusions

As coats of armour were quite costly and complex they were not widely issued to Late Bronze Age soldiers. For a soldier to receive a coat of scale armour, he first must have been well-trained and part of a military establishment which had a substantial economic background (i.e. a palace economy). Furthermore, he must have been of a social class such that he would have been involved with the chariotry, either as a chariot warrior or driver. Finally, he must have been part of a "regiment" of chariot soldiers which would be deployed in military situations where bodily harm was not unexpected. It is also reasonable to assume that the higher the social status that the soldier had, the higher the quality of equipment he might receive. The connection of the elite with body armour is also noted in the presence of armour in a few burials as discussed above, however it must be noted that even amongst the wealthiest soldiers, body armour was not necessarily an intrinsic part of their accoutrement.

Tactics would also have affected the use of military equipment. A group of soldiers wearing heavy coats of metallic scale armour would not be able to move as quickly as a group of unarmoured soldiers, and would therefore be slower to deploy in military situations. Although the heavily armoured soldiers would be somewhat less likely to receive life-threatening injuries, they may not have been the best choice of forces to deploy given the particular events of a given battle. Armour was not useful in all situations, especially when it was not suited to a particular task. Although written in the early 19th century AD and concerning events of the late 12th century AD, an example which illustrates this situation is presented in Sir Walter Scott's epic account of the story of Wilfred of Ivanhoe which notes that a soldier well-equipped for a highly mobile task may be ill-equipped in other situations:

> Said the Saxon; "...The quarrel is mine, and well it becomes me to be in the van of the battle."
> "Yet, bethink thee, noble Saxon," said the knight *[King Richard]*, "thou hast neither hauberk, nor corselet, nor aught but that light helmet, target *[shield]*, and sword."
> "The better," answered Cedric; "I shall be the lighter to climb these walls..."
>
> Ivanhoe, Sir Walter Scott (1954: 318 [reprint of 1830 edition])

Uneven terrain or narrow paths and roads would prevent the speedy deployment of chariot troops, thus rendering those forces relatively useless in certain military situations: a fast attack over rough ground would not be possible with massed chariotry. Much of this would depend on the actual style of fighting employed by Late Bronze Age soldiers. It is unknown whether or not the chariot warriors fought exclusively from the chariots or if they occasionally also fought on foot, having dismounted. It is unlikely that the lives of the wealthy elite soldiers would be needlessly risked by equipping them with weapons and armour unsuitable for the tasks they were to perform. Furthermore, it is unlikely that all of the wealthy elite soldiers would have purchased equipment to their own tastes, thus making each chariot an individual fighting unit.

If the chariot warriors fought as a "commando" group making use of the tripartite arrangement of chariots, composite bows, and body armour (as has been suggested in Chapter 5.1.2), they would have had to fight in a manner that each of their comrades would know how the others would act in a given situation, both on foot and mounted on the chariots. Some level of uniformity in equipment must have been maintained so that they could fight as a concise unit and be deployed *en masse* with the expectation that if a chariot should be lost in battle, any other could readily fill the gap for the duration. This may be part of the case where the Nuzi texts speak of individuals keeping their arms and armour as a personal possession. They may have been issued with equipment by the palace and charged with its maintenance, or they may have purchased their own "regulation issue" equipment. Furthermore, the retention of armour as a personal possession would tend to allow the soldier to become more accustomed to it, and thus allow him to fully assess how much protection it would afford and therefore make him a better, and more effective soldier.

There is also little evidence for the wealthiest of the elites having had especially complex or highly decorated armour made strictly for display and conspicuous consumption. The Late Bronze Age texts do not *specifically* mention this instance, nor do the contemporary reliefs *specifically*, to the best of current knowledge, depict armour that was made for this purpose. Furthermore, excavations have not yet produced armour in sufficient quantity to examine this fact more closely. Armour made for this purpose may have existed, the green and red glazed ceramic scales from Pi-Ramesse being possible examples, as the depiction of the banded coats of armour from the tomb of Ramses III (see Lorimer 1950: 198) may reflect a coat of parade armour. The specifics of design and manufacture of the coat of armour in Tut'Ankhamūn's tomb is something of a mystery. The armour itself would probably have been effective at stopping some projectiles from a distance and would serve to lessen an injury received in hand-to-hand combat, however it seems by its component materials to be slightly out-of-place in a tomb where most objects are made of precious and semi-precious materials. In any event, the value placed on armour, whether symbolic or "monetary", was evidenced by the occasional dedication of armour in the temples. This would suggest that the armour was a suitable offering for the gods and that the individual who dedicated it, either as war booty or of domestic manufacture, was wealthy enough to remove such an item from active service.

Shaw (1996: 239) notes that the battlefield is one of the most ephemeral of man-made features in the archaeological record. Much of what would have been deposited during battle would have been recovered later, including any weapons and metal objects. A damaged coat of armour would have been a prime article to reclaim for recycling as noted above, and if any scales had come loose from the armour, they would be scattered about the battlefield. As there are few, if any, Late Bronze Age battlefields for which the precise location is known, the chance of finding damaged armour scales is remote. This is especially true if the majority of the armoured troops wore organic armour. Should bronze armour have been worn only by the highest of the elite, the chance of finding metal scales would be even more remote as these individuals would probably be amongst the least likely to be struck in battle. This would of course depend somewhat on the type of armour worn by the elite charioteers.

The manner in which armour was used (as an item of military equipment) by the soldiers would probably have remained mostly unchanged as long as the methods of warfare did not change. The social aspects could, however, have changed considerably. The use of body armour in the Late Bronze Age Middle East is best described as a balance struck between the usefulness of the armour versus the great cost of manufacture, and considerable amount of experimentation must have occurred to establish this balance. Various social aspects also must have been factored into the equation, foremost amongst which was that the individual in receipt of body armour actually needed it; either for the physical protection it offered, or to convey his military status. In the final assessment of the use of armour in the Late Bronze Age, reference must again be made to Yigael Yadin (1963: 3):

> "...in the final analysis the art of warfare is to seek to achieve supremacy over the enemy in three fields: Mobility, Firepower, Security. To put it another way, it is the ability to move troops to engage and injure the enemy without serious injury to oneself."

The use of body armour would be acceptable, with respect to the quote above, if it *did not* overly restrict mobility, *did not* impede firepower, but *did* provide suitable added security. Furthermore, regardless of the status of the wearer, it would also have had to have been a financially feasible option. The bronze scale armour would restrict movement, but would not impede firepower. The effectiveness of this type of armour was proved in Chapter 3. With respect to the statement above, the composite bronze/rawhide armour tested in Chapter 3 was proved to have been just as effective as the all-bronze armour, but at a decrease in weight. As such, it would perhaps be the better choice. The balance between these factors must be addressed again in the case of the rawhide scale armour, as the increase in mobility afforded by the decreased weight would come at a decrease in protection. Again, as Glock (1968: 15) has noted, "The thinking behind the armour of the soldier appears to be motivated by desire for mobility".

The allocation of armour to soldiers was not based on altruism. The armour would keep a soldier on the battlefield for a longer period and this may have helped to win the battle. With evenly matched opponents, both similarly equipped, this may be a cancelling factor, but nonetheless every effort could help in the longer term. As has been noted throughout this thesis, armour was a costly item, symbolic value not withstanding, and as such was not casually distributed to the soldiers. Armour could impede the movements of some soldiers thereby causing them to be less effective at their tasks than necessary, but also may have saved lives which were necessary to win the battle. In all events, the use of armour was based on a series of balances: weight vs. mobility, mobility vs. effectiveness, effectiveness vs. casualties, casualties vs. expense, expense vs. victory.

This study of body armour serves to show that the production and use of military equipment was not as straightforward as has often been assumed in the past. The provisioning, equipping, and general day-to-day running of the Late Bronze Age military structures would have, to a degree, involved almost every citizen of a given polity to one degree or another. Furthermore, there would be local differences in the manner in which the military and its equipment was thought of by the populace - by both the elite and the non-elite sectors. This thesis has attempted to bring together a broad range of methods for studying the ancient military: artistic elements, textual elements, archaeological remains, and experimental archaeology. Each of these aspects have brought forth important points which have been important in studying the manufacture and use of body armour, however none of them have exhausted the material. Each of the aspects could be studied in much greater depth, and it would be beneficial to the broader understanding of the ancient military if this should occur. Just as the modern 20th and 21st century AD military establishments draw from the civilian economy, so to did the military establishments of the Bronze Age, and for a better understanding of the whole of the Bronze Age, a better understanding of the military is necessary.

Appendix 1

The Sea Peoples' Organic (Rawhide) Armour

The majority of this appendix is based upon the thesis written by the present author as partial qualification for the Master of Arts degree in Eastern Mediterranean Archaeology at Katholieke Universiteit Leuven, Belgium in 1995/1996.

The Sea Peoples' Armour depicted in the Naval Battle relief at Medinet Habu

Central to the discussion of organic armour in the ancient Near East are the reliefs of the Sea Peoples on the temple of Medinet Habu situated five kilometres south west of Luxor on the west side of the Nile. The depictions of the land and naval battles against the Sea Peoples are located on the exterior of the north wall of the temple and record the so-called "invasion" of Egyptian territory by the groups which are now commonly referred to as the "Sea Peoples". The most important scene for the discussion of organic armour is that which depicts the naval battle.

Many depictions of soldiers, especially those in the reliefs of New Kingdom Egypt, show soldiers wearing what might be interpreted as simple leather armour. The number of these reliefs, and the detail within them, is most often insufficient to allow the formation of hypotheses concerning the materials, construction and use of this type of armour. The only such depiction of large enough size and detail are the reliefs of the land and naval battles which Ramses III fought in his 8th regnal year (c. 1185 B.C.) against the Sea Peoples.

Examination of the reliefs at Medinet Habu is not easily undertaken due to their placement high on the walls of the temple, so reference is made almost exclusively to the original detailed publications of the reliefs in Volumes 1 and 2 of the Medinet Habu series published by the University of Chicago Oriental Institute in 1930 and 1932 respectively. Plate 37 (Volume 1 of the Medinet Habu series) depicts the Naval Battle in which are show nine ships engaged in battle (five Sea Peoples ships and four Egyptian Ships) along with Ramses III and some of his land-based troops standing on the banks of the river loosing arrows into the battle (Fig. 86).

The appearance of the Sea Peoples soldiers as they battle the forces of Ramses III is one of a group who are suffering annihilation. The various Sea Peoples are engaged in battle with no projectile weaponry, while the Egyptian forces utilize both archers and slingers, the archers loosing arrows from the Egyptian ships and from the shoreline (alongside Pharaoh, who also is engaged in archery). As is usual within Egyptian artistic convention, there are only injured and dead Sea Peoples soldiers depicted. Most of the Sea Peoples soldiers are wearing a form of corslet which may be interpreted as being made of an organic material, (most likely rawhide).

Four basic types of armour are depicted, with one style in particular being the most common. The "Sea Peoples" type of armour is basically formed of several overlapping bands, or lames, of leather with a broad band at the lower hem and a breast- and back plate at the top which covers the upper chest and back. In each of the four styles of this armour (Fig. 87) the components for the front are all attached to each other as are the sections for the back, such that broad gaps would not open between the bands during movement. The two halves are then attached to one another, probably laced down the sides. In types 1, 2, and 3 each of the bands of material, excepting the lowest band (or hem) will rise in an inverted V shape. In the fourth type these bands dip downwards an upright V shape (Hulit 1995: 11). A description of the component parts of the armour may be found in Fig. 87.

The horizontal bands on Type 1 (Fig. 88) cross the torso, each band rising in the middle. Each of the bands is almost identical to the one below it, and there are from two to eleven bands in this style. The upper chest and upper back are protected by a placards (short breast- and back-plates reaching approximately half way down the torso) to which pauldrons are attached.

Type 2 armour (Fig. 89) is quite similar to Type 1 except that the lames appear to have a deeper angle. Two of the lames have a more triangular shape and continue up to the neckline, perhaps layered over one another to provide greater protection to the pectoral region and upper chest and back. The presence of pauldrons in this style of armour is unlikely.

Type 3 armour (Fig. 90) is again similar to Types 1 and 2, but does not include the upper placards. The lames across the chest appear to be constructed with a deeper "inverted V" angle and overlap one another rising all the way to the neckline. Again, as in Type 3 armour, the presence of pauldrons is unlikely.

Type 4 armour (Fig. 91) may be simply a variation in the artist's methods and interpretations as it appears clearly only once on a live Sea Peoples soldier and possibly once more on a dead Sea Peoples soldier. The lames comprising the body of the armour appear to be inverted in an "upright V" formation. If this form did exist, it would appear quite similar to Type 1 armour, aside from the inverted lames. The upper placards would need to be longer to provide coverage left open by the inverted lames, while the lowest hem-lames would need to be as long as in the other Types to protect the sides of the body where the sides of the lames rise.

The depictions of the Sea Peoples soldiers in the Naval Battle relief shows them wearing some form of undergarment beneath the armour. This garment may have been similar to the padded gambesons worn by Medieval European soldiers beneath a variety of types of armour. The climate in the Near East, particularly in the summer months may have made a heavy, padded garment inappropriate. Following the discussion below concerning the manufacture of a replica corslet in the Sea Peoples style, the author has found that wearing a simple T-shirt beneath the replica armour is sufficient to prevent chafing, although such a thin garment would provide no great added protection in battle.

A variety of opinions exist concerning the material from which the Sea People's armour was made, all of them rather vague due to the lack of information. Daremberg and Saglio (1904) acknowledged that the appearance of the Sea Peoples in the Medinet Habu relief of the naval battle suggested armour, but declined from hypothesising on its structure. Lorimer (1950: 200) states that the armour is "...almost certainly metallic..." but gives little justification for this belief. Yadin (1963: 251) and Earle (1990: 43) acknowledge that there is no way to be certain whether the armour is made of metal or leather, but believe that metallic armour is more likely as the Sea Peoples army was devised for hand-to-hand combat.

Armour made from sheet-bronze is known in the example of the Mycenaean armour from Dendra (see: Verdelis 1977), so it is not impossible that the Sea Peoples' armour may have been made from metal. However, the amount of labour that would be necessary to fashion plate copper or bronze armour for the approximately 125 Sea Peoples soldiers depicted in the relief of the naval battle (much less the entire Sea Peoples army) would be immense. Furthermore, the cost of the bronze alone would be substantial, and therefore not consistent with a non-elite community.

Armour made from a hide product in the Sea People's style would be much easier to manufacture than similar metallic armour (see text below describing the manufacture of the replica Sea Peoples-style corslet). The leather would have been much cheaper than bronze, and probably took fewer specialized skills to form into useable armour. "Plate" armour, formed of inflexible, or relatively inflexible, sections, would need to have been custom fitted to each soldier, thereby increasing the amount of labour involved in the manufacture. As rawhide or leather would be much easier to obtain than bronze or copper sheet metal, and much more quickly formed into the required shapes, it is the more likely material to have been used (the effectiveness of this type of armour is discussed in Chapter 3). Repairs to sheet-metal work are fairly complicated and generally require intense heat for brazing or welding, while damage to leather armour during use should take considerably less effort (and equipment) to repair. Simple repairs to the leather armour may have even been within the skills of the soldiers making use of this armour, obviating the need for many skilled armourers.

The fact that no surviving examples of metal armour of this style exist also suggests that an organic material was used. The final point that may suggest that the armour was made of leather is that in the relief of the naval battle, the dead and injured Sea Peoples soldiers which have fallen overboard appear to be floating (there are also instances in this relief of Sea Peoples soldiers being pulled out of the water). If a soldier was wearing metal armour of 10 kg or more in weight, plus the padding beneath it (and other clothing which would soak up water), and a helmet, it is likely that he would sink if he fell into the sea. This bit of conjecture is, of course, based on how one interprets a scene which is all to sparse in detail.

A1.1) The Manufacture of the Replica Sea Peoples Armour Corslet

In January of 1997 the author began the construction of a replica Sea Peoples' corslet. This replica was based on the hypotheses formulated in the research outlined above with some further observations and changes coming to light during the construction. This corslet was tested against archery in the experimental work at H.M. Royal Armouries Museum in 1999 even though the waxed leather from which it was made was actually inappropriate (see Chapter 3.3.1).

To reduce the cost of manufacturing the replica armour, a half hide of the cheapest leather was purchased. Final observations suggest that rawhide would have been the best choice for the manufacture of this armour, but would have been more difficult to work with and more expensive than the leather that was used. The chosen leather was an inside split (suede on both sides) of a "chrome re-tanned" hide. The tanning of this leather involves a partial chromium tan (approximately 10 days in solution) with a final vegetable tan (also approximately 10 days). This method of tanning allows the leather to have the most of the characteristics of a completely vegetable-tanned hide (typically 30+ days in solution) while decreasing the time the hide is in the tanning solution. The hide purchased was some 3mm in thickness.

Specific measurements of the author's body were taken with a tape measure with a further small percentage (approximately 5%) added to the circumference of the torso to account for any clothing that would be worn beneath the finished armour. These measurements were then transferred onto the leather in the appropriate shapes for the armour. Certain factors were unknown, such as the necessary number of lames of a given width and the overall size of the neck aperture. Extra lames were cut from the hide and an additional amount of leather was left in the opening for the neck. The front and back lower placards, or hem-lames, were also cut out at this point (Figs. 92a, 92b, 92c, and 92d).

The lames for the front and the back of the armour were then taped together overlapping approximately the same amount as when finished (Fig. 93a). In this manner it was decided that there should be four lames on the front and four on the back in addition to the lower hem-lames and the upper placards. The whole armour was taped together with each piece in approximately the correct final position and measurements were taken again. As this armour was tailor-made to specific measurements, it was found that to ensure a proper fit on the author, the final armour would have to taper somewhat from the shoulders to the waist. As such, the upper lames were left at their original length, while increasing amounts were trimmed from the ends of each of the lower sets of lames. This allowed each "level" or row of lames to slide under the pair above it without binding. The placards were also trimmed so that they too would fit inside the uppermost pair of lames. At this point the holes were punched into the ends of the lames and the placards to allow the whole armour to be laced together with leather laces (Fig. 93b - upper placards laced together). The shoulder straps of the placards were laced together in a simple cross-lacing pattern while the sides of the armour (the lames) were laced together in a linear straight-crossing pattern (Fig. 94).

The finished armour was then unlaced and water-hardened to stiffen the armour and thereby achieve a finished product more like armour made from rawhide. Although this armour would likely not protect the wearer as well as rawhide would, for purposes of testing armour fit and mobility, it was considered sufficient. The water hardening process involved soaking all of the sections of armour in water just below boiling temperature and allowing them to dry over forms (Figs. 95a and 95b). This process, due to the partial chromium tanning process described above, was not very effective, only slightly increasing the rigidity of the armour. At this stage it was then decided to wax-harden the armour. This process involved heating the sections of armour in an oven to a temperature of approximately 150 degrees Celsius and then "painting" them with molten paraffin wax until they had become thoroughly impregnated with the wax. Upon cooling, the armour sufficiently rigid to examine the final fit and mobility.

Upon wearing the armour it was determined that the lames would concertina within each other allowing the wearer to move in a normal manner without the armour binding. Gaps would open between the lames on bending the body forward or backward, so it was decided that a single lace should be added inside the front and back sections of lames, tying them loosely together to prevent any gaps from opening. Each lame has a pair of small lacing holes punched at the apex of the "point" in the centre of the lame, with the front and back upper placards having a single hole punched at the centre of the lower edge. The lowest hem-lames also have a single hole punched at the apex of the central "point". A leather lace which has been threaded through all of these holes is knotted at each lame and runs on the inside of the armour (Fig. 96). This lace does not show when the armour is fully laced together (Fig. 97). The experiments in Chapter 3 have shown that this form of armour provides a modest amount of protection.

Appendix 2

The Principles and Methods of the Manufacture of Rawhide and Leather

The material from which the armour found in the tomb of Tut'Ankhamūn was manufactured is rawhide. This identification of this material was made by the characteristic pale yellow to golden translucence of rawhide. To the author's knowledge, rawhide is the only hide product which exhibits this characteristic. The initial examination of the armour in 1999 (see Chapter 2.3.3.1) suggested that the material was alum tawed leather, and as such, both of these materials were used in the manufacture of sections of replica scale armour (see Chapter 3). Both of these materials shall be discussed below.

A2.1) The Structure of Animal Hide

The hide, or skin, on an animal consists of three layers: the epidermis, the corium/derma, and the adipose tissues/fat (Fig. 98). The epidermis, removed in the early stages of the tanning process, is a very thin layer formed of cellular growths arranged like rows of bricks, with dead cells gradually moving closer to the surface. The main structure of leather, or rawhide, is the corium/dermal layer which is made up of cells (both live and dead) and cell products which take the form of a felt-like mass of collagen fibres. The scattered cells produce fine fibrils which are grouped together to form fibres, which are grouped together to form fibre-bundles, all of which are held together by a fine filament network called recticular tissue(inter-fibrillary proteins) (Sharphouse 1983: 22, Forbes 1966: 1-2). The collagen fibres are tightly woven together in the bundles with no loose fibres extending into the epidermal layer. The careful removal of the epidermis early in the stages of the tanning process will reveal the smooth hyaline layer which is between the corium and epidermis (Sharphouse 1983: 22). Once the epidermal layer and the adipose (fat/flesh) layer is removed, the remaining corium is processed into rawhide or leather.

A2.2) The Production of Leather

Preparation of a hide prior to tanning involves eight basic steps (Sharphouse 1983: 6). When the desired end product is rawhide, the procedures listed below are stopped at the seventh stage (Fig. 99).

1) *Flaying* - Removing the hide from the animal
2) *Curing* - Preserving the skins during transport or storage
3) *Washing* (wet salted material) or *Soaking Back* (dry material)
4) *Liming* (and *Sweating*) - to loosen hair, fat, flesh, etc.
5) *Unhairing* - to remove the hair
6) *Fleshing* - to cut away the unwanted fat and flesh from the inner side of the hide
7) *Deliming* - to neutralise the alkali from stage 4
8) *Bating* - to make the hide softer and cleaner

Production of leather begins with a freshly flayed animal hide. In some circumstances, hides may be temporarily preserved from decay in their untanned state for storage or shipping prior to being tanned. These procedures generally involve salting the wet hides or drying them in specific conditions. For the sake of brevity, a discussion of these procedures shall not take place here (for more on this see: Reed 1972, Sharphouse 1983). The description below concerns the production of hairless rawhide and leather. Production of fur pelts involves some different procedures (again, for more on this see: Reed 1972, Sharphouse 1983).

The hide need not be cured or preserved in any manner if it is to be immediately processed. Should the tanning processes be delayed, some form of action must be taken to halt the decay of the fresh hide. This usually involves either a process of applying salt to the hides or carefully drying the hides. Prior to processing, the hides must be soaked back into their raw state, and in the case of salted hides, to remove the alkali compounds.

In processing hides for leather, rawhide, parchment, etc. the hair must first be removed along with the epidermal layer. The earliest method of removing the hair (*unhairing* the hide) was to "sweat" the hides in a room with a relatively controlled atmosphere. The hides were left in a dark, humid room and held at a temperature of 21 to 27 degrees Celsius for 20 to 40 hours until the hair was loose. These conditions will allow bacteria to thrive and thereby attack the keratin cells of the epidermal layer. The hides were then taken down and draped over a wooden beam and the hair "pulled" or scraped from them with a dull concave knife. The hides would then be rinsed in water and soaked in a lime solution (or *liquor*) to stop putrefaction (Sharphouse 1983: 96, 99, Forbes 166: 4). Unhairing the hide may also be done as part of the liming process which also cleans and loosens the dermal fibre structure of the corium layer, expanding the structure ("plumping" the hide). Manual hair removal, as with the sweating process, is still necessary (Reed 1972: 51, 53). After unhairing the hide the unwanted flesh and fatty tissue still adhering to the inner side of the hide is removed by draping the hide over a wooden beam and carefully cutting away the remaining material with a sharp concave knife (Sharphouse 1983: 114, Reed 1972: 53, Forbes 1966: 4).

After fleshing, the hide may be scudded. This process is traditionally done over the wooden beam with the dull concave unhairing knife. The process involves carefully scraping the surface of the hide to squeeze out any remaining hair follicles, hair fragments, lime residue, dirt and grease prior to further processing (Reed 1972: 53). After the processes described above are complete, the hide is delimed. The remaining lime in the hide will impede the tanning agents, so it is important that the lime compounds are removed. Traditionally, this process involved simply washing the hide in flowing water. Another method, more recent, is to place them in a paddle-drum which is run with a continuous flow of water (Sharphouse 1983: 126, see also Reed 1972: 54-55).

If the hide is to be tanned, the hide may then be bated. This process, of uncertain origin but used in the ancient world, originally involved placing the hides in an warm, aqueous solution of dog, hen, or pigeon dung. The bacterial enzymes in the solution attack the inter-fibrillary proteins (recticular tissue) and thus partially degrade the collagen structure of the corium/dermal layer which, after tanning, produces a softer, more flexible leather (Sharphouse 1983: 131, Forbes 1966: 55-57). This process would probably be undesirable in processing tanned or tawed leather for armour production, as a soft, flexible product would be undesireable

A2.3) Alum-Tawed Leather

As tanned leather was not utilized in the experimental work (see Chapter 3), the various tannages used in the ancient world shall not be discussed here. For more on this topic, see Forbes 1966, Reed 1972, Sharphouse 1983, and van Driel-Murray 2000. The "tannage" used in production of the white leather used the manufacture of one of the sections of replica scale armour is more correctly termed "tawing". The tawing process involves submersing the raw hide in an aqueous solution of potash alum at a temperature of 20 to 30 degrees Celsius. The chemical process in this mineral tannage involves the mineral salts (alum is double salt of aluminium and potassium sulphates) fixing onto the acid groups of the proteins in the hide where it displaces some of the water. It may also form complexes of two or more metal atoms which may then form cross-links between the adjacent acid groups on the skin collagen molecules. This process stabilizes the wet hydrated structure of the skin. When the hide drys, it will shrink and become relatively hard (Reed 1972: 62-64, Sharphouse 1983: 147-148). Alum tawed leather is not particularly water resistant, and the alum compounds may be washed out of the hide, returning it to almost its raw state. After processing, the tawed hide may be hung to dry in a circulating current of air. The longer the hide is hung to dry, the more water-resistant it will become. The leather may also be softened by staking (stretching and pulling) it over a dull knife. This process produces a characteristic snow-white leather which has in modern times been replaced by a more water-resistant aluminium chloride or aluminium sulphate tannage (Reed 1972: 63).

A2.4) Rawhide

The production of rawhide is a more simple process which stops at the seventh stage as noted above. The wet, raw hide is stretched over forms and left to dry, producing a transparent, untanned, and very hard product which is still susceptible to water (see Reed 1972: 9). Rawhide is a suitable product for hard-wearing goods in dry climates where it will not see contact with much water. Some rawhide items from ancient Egypt have survived, such as a 12th dynasty rectangular container which was moulded into shape and a 19th dynasty harp, the body of which was covered in rawhide (Forbes 1966: 9). Rawhide thongs were used in Dynastic Egypt to bind axe-heads onto hafts as well as to bind the joints of furniture and chariots. Applied wet, the thongs will provide a very strong joint when they dry (Forbes 1966: 24, 26). In the tomb of Tut'Ankhamūn rawhide was used in the manufacture of chariots as well as the coat of scale armour (see Chapter 2). Rawhide was used in the chariots for binding the joints in the wheels, as a bearing for the axles, and as woven lattice for the floor of the chariot cab (Forbes 1966: 34). Howard Carter noted in his initial excavation artefact card catalogue (held at the Griffith Institute, Oxford) that some of the rawhide in the coat of armour had decayed into a fused and blackened mass. Forbes (1966: 32) suggests that this material was the result of insufficient tanning. In this he is not incorrect, as the hide was never tanned at all, however the rawhide has undergone several thousand years of changes in heat and humidity in the tomb and has probably gradually suffered from both biological decay and the slow change of the collagen structures into gelatin due to heat and humidity (Dr. C. Caple, Durham University, pers. comm.).

A2.5) Oil-Cured Leather

Upon further research into ancient leatherworking, the possibility has arisen that the hide product from which Tut'Ankhamūn's armour is made may have been mis-identified. The armour may have been made from a form of oil-cured leather. Leatherworking is quite often depicted in Egyptian tomb reliefs, and it is believed that the depictions represent oil-curing rather than vegetable tanning, as there is no evidence for vegetable extracts (van Driel-Murray 2000: 303). The possibility that Tut'Ankhamūn's armour was made from oil-cured hide is based on van Driel-Murray's (2000: 303) note that this form of leather will gradually break down by hydrolysis in warm and damp conditions into a glossy black gelatinous mass. Upon examination of Tut'Ankhamūn's armour in February 2000 (see Chapter 2), several pieces of a black gelatinous matter, similar to that described above, were found within the box of armour.

There is considerable overlap in the "tanning" methods in ancient Egypt, and it is difficult to identify trace elements which may determine the original process (van Driel-Murray 2000: 316). As there were many items in Tut'Ankhamūn's tomb which were made of rawhide (i.e. the lashing on chariot joints, chariot tyres, etc.) (van Driel-Murray 2000: 310), it is possible that Tut'Ankhamūn's armour was made from rawhide. As no samples were available for testing, it is unclear at this point exactly what type of material was used. Furthermore, it is not known how effective oil-cured leather would have been when made into scale armour. Further experimental work would be desirable.

Appendix 4

Construction of the Replica Egyptian Composite Bow as used in the Experimental Work for Chapter 3

The replica composite bow used in the experimental work discussed in Chapter 3 was made by master bowyer Edward McEwen in London. The bow was commissioned by H.M. Royal Armouries Museum specifically for this research into the effectiveness of replica Eastern Mediterranean scale body armour. The text below is based primarily on an interview with Edward McEwen which took place in London on 8/10/2000 at his home and workshop.

The style of the composite bow used in the experimental work was based on an aggregate of the styles and measurements of the standard composite bows found in the tomb of TutʿAnkhamūn and on the remains of others found in the Near East, all of which date to the Late Bronze Age. As can be seen in Fig. 100, the nocks of the bow are shaped to represent a duck's head, and are based upon reliefs from the Assyrian period. These are not contemporary with the style of bows found in Tutʿankhamūn's tomb, but are not thought to affect the performance of the bow to any great extent. Aside from this difference in appearance, the bow was made as true to the originals as was possible. It is not possible to present specific measurements for the composite bow used in the experimental work as they were not recorded during manufacture of the bow. The measurements of specific components and the final, finished measurements vary considerably during the manufacture of any bow, depending on the desired final draw-weight and shooting characteristics.

The bow was made in several stages, each requiring several processes. Each of the major stages is illustrated in Figs. 101 and 102. The glue required at several stages in the manufacture of this type of bow was made by boiling shredded isinglass (fish swim-bladder) in water, adjusting the quantities of both parts, until the desired consistency was achieved. Although this glue must be used hot and takes a considerable amount of time to set properly, it provides a very strong, but flexible bond. It also remains malleable longer than glue made out of rawhide, making slight adjustments of joined pieces less difficult once they are all in place. In the opinion of McEwen (pers. comm.), for the manufacture of composite bows it is superior to any other form of natural or man-made adhesives.

A4.1) Stage 1 - Formation of the Wooden Core (Figs. 101a and 101b)

The core of the bow used in the experimental work (see Chapter 3) was made from European Ash (*Fraxinus excelsior*). Although this particular species of ash is not indigenous to the Egypt, it was deemed suitable for use in the core of the bow as the core of the bow does not greatly affect the final performance. The core serves as a medium onto which the horn belly and sinew back of the bow will be glued and is consequently protected from chrysalling (crushing fractures) and cracking by these materials as the bow is used. The sinew has great elastic strength while the horn has great compressive strength. These two materials work together in a composite bow: The horn (great compressive strength) on the belly does not compress easily, forcing the sinew (great tensile strength) on the back to stretch. If the composite bow is constructed properly, the wooden core should be a zone of almost neutral tension (Miller, McEwen, and Bergman 1986: 183, see Grayson 1993: 113-154 and Tan-Chiung, T'an (1981).

It is uncertain which particular species of ash was used in the bows from the tomb of Tut'Ankhamūn, however one example (Carter's tomb number *370 hh*) has been broadly identified as *Fraxinus Sp.* and also as *Fraxinus ornus* (Manna Ash) (Western and McLeod 1995: 90-91, McLeod 1970: 21, 31). *Fraxinus exclesior* (European Ash), *Fraxinus ornus* (Manna Ash), and *Fraxinus syriaca* (Syrian Ash) could all be argued to have been available for bow cores as they are all available to parts of the Ancient Near East. European ash can be found in Syria and Lebanon, while Manna ash and Syrian ash can be found as far south as Palestine and on the Anatolian coast. Remains of Syrian ash has also been found as far south as Beth Shan (Western and McLeod 1995: 90-91). The most common wood used for manufacturing archery tackle in Egypt was the indigenous Acacia (*Acacia Sp.*) (See Western and McLeod 1995: 88), with the specific species *Acacia nilotica* (indigenous to the Nile Valley), and *Acacia albida* (indigenous to the area of Aswan) being perhaps the most suitable. In an attempt to purchase suitable lengths of "Egyptian" Acacia for the manufacture of bows, the author found no single supplier in the entirety of Europe able to supply even small quantities of this wood. With the well-known trade and exchange systems that operated in the ancient Near East (valuable goods, metals, etc.), it is not unreasonable to assume that small quantities of high quality woods eminently suitable for manufacturing sophisticated composite bows may also have been traded or exchanged for.

A straight lath of ash wood (*Fraxinus excelsior*) was taken and tapered evenly in both width and thickness the centre out to the tips. The centre of the lath was then steamed over a pot or kettle of water for some time, softening the wood and allowing the lath to be bent at an angle of approximately 20 to 25 degrees. The lath is then left clamped in this position and allowed to dry. When the lath was completely dry, a piece of wood was cut and glued onto the back of the bow to strengthen the bend and help preserve the angle once the clamps were removed Two small sections of wood which would later be formed into the nocks of the bow were then glued and clamped to the tips on the back of the bow. The glue was allowed to set for many days before removing the clamps.

A4.2) Stage 2 - Application of the Horn Belly and Sinew Back (Figs. 101c, 102a, 102b)

Upon removing the clamps from the lath (the "skeleton" of the bow), the belly and back of the limbs were then lightly scored lengthwise with a grooved tool. The sections of horn (discussed below) were also scored in a similar manner. This process provides a better surface for the glue to adhere to by greatly increasing the surface area, thus ensuring a stronger final bond.

To achieve the reflexed form in the finished bow, the ends of the lath were then tied together with stout cord, reflexing the limbs (Fig. 101c). Prior to application, 14 to 16 short, flat sections of Water Buffalo (*Bubalis bubalus*) horn were cut to size, tapered in thickness slightly on both ends, and scored on one side. Isinglass glue was then applied to the belly of the bow and smoothed into a suitable thickness. Beginning at the grip, the six to eight pre-shaped layers of horn were laid onto the belly of the bow, overlapping towards the tip (Figs. 102a and 102b). These sections of horn were then tightly tied into place and left to set for approximately six weeks.

The next stage was to lay a set of strips along the sides of the limbs of the bow. These strips are most often of horn in Egyptian bows (McEwen, pers. comm.), but wood (ash wood [*Fraxinus excelsior*]) will also suffice, as was used in the manufacture of the bow used in the experimental research for this thesis. The dimensions, and material used, for these strips will affect the draw weight, and thus the performance, of the finished bow. The glue was allowed to set for a few days prior to the next stage of manufacture.

After the horn belly and the side strips were attached to the core, the sinew was laid onto the back of the bow (Figs. 102a and 102b). The sinew was prepared from the hind leg Achilles (heel) tendons of domestic cattle (*Bovis Sp.*). The particular species of animal from which the tendons are taken does not seem to affect the final performance of the bow, given that they are from a large animal (ie. cattle, deer, etc.), however the location of tendons in the body is important. The Achilles tendons or those from the back of the animal are suitable, but the tendons from the neck of the animal are not acceptable (McEwen, pers. comm.). The dried tendons were pounded until the sinew fibres were separated, at which point they were combed out and sorted into bundles of fibres of approximately equal length. The bundles were then soaked in hot isinglass glue prior to application to the bow.

With the limbs of the bow still tied together to reflex the limbs, the glue-soaked bundles were evenly laid onto the back of the bow (Figs. 102a and 102b). The bundles of sinew were overlapped slightly and smoothed down, tapering slightly so that the sinew was thicker at the grip than at the tips of the limbs. Once this process was complete, the glue was allowed to set for approximately six weeks. Depending on the desired draw weight of the finished bow, this process can be repeated until up to three layers of sinew have been applied, allowing approximately six weeks for the glue to set in between each application. After the final layer of sinew was laid, a thin wrap of sinew was applied around the circumference of the limbs over the overlap of each of the sinew bundles to strengthen these joins (Fig. 102c). Once the glue was set, the cord was removed from the tips of the bow, resulting in a slight reduction in the reflex of the bow, but still retaining the unstrung double arced shape of the ancient Near Eastern composite bows.

At this point in the manufacturing process the nocks at the tips of the limbs are fashioned to take the loops of the bowstring (Fig. 102c). This is done using a set of simple carpentry tools and a round-file. Once the nocks are formed, the bow is tillered. This process involves gradually drawing the bow back on a tillering brace. This section of wood has a grooved end to accept the grip of the bow, and a series of cuts along the side, allowing the bow to be drawn back and held in successive stages towards full draw. Tillering a bow involves measuring and visually inspecting both limbs of the bow to ensure that they bend evenly which is critical for achieving correct performance. For an example of the use of a tillering brace, see Fig. 103c. The tillering of an Egyptian-style composite bow is done primarily through heating and bending of the limbs at the required point, however, if sufficient attention is paid to the symmetry and evenness of the limbs during manufacture, little tillering should be required.

The final stage of production of the replica Egyptian composite bow was the application of the birch-bark waterproof covering (Fig. 102d). This is done by soaking strips of soft birch-bark in low-viscosity isinglass glue and laying them lengthwise onto the bow. Further decoration can (and was in this case) made after the glue had been allowed to set. After the bow was finished, a suitable string was fashioned (also by McEwen) from linen. The bow used in the experimental research for this thesis is depicted in Figs. 100, 104a, 104b, and 104c.

Appendix 5

The Production of the Arrowheads used in the Experiments

It is difficult to date arrowheads by their typology. This is sometimes due to a lack of change from one period to the next in shape and form. The differences in arrowhead shape and form are often due to slight variations in their manufacture. The metallographic study of the arrowheads which Khalil (1980) has conducted shows that they were roughly cast and then heavily hammered and annealed more than once, with the heavy hammering causing differences in their final shape (Khalil 1980: 25-26). The arrowheads used in the experimental work in this thesis are similar to catalogue artefacts 51 to 60 in Khalil (1980: 26-27). The tin content of these arrowheads ranges from 97.6% copper with no discernable amount of tin (from the Amman Airport, catalogue #56) up to one with 88.9% copper alloyed with 8.26% tin (from the Amman Airport, catalogue #51). There are other trace elements in the arrowheads studied including arsenic (up to 1.68%), lead (up to 0.234%) and zinc (up to 0.0851%). The arrowheads manufactured by the author for the experimental work contained up to 2% zinc (a constituent of the gunmetal bronze used in the casting) and approximately 10% tin. This alloy was the most accessible material available at the time of casting, and is a slightly harder alloy than that used in the Late Bronze Age. It is not believed that this adversely affected the results of the experimental work, but rather would perhaps represent the hardest alloys available at the time, and in conjunction with the distance at which the armour was tested (7 metres), would effectively result in testing the armour "to extremes".

Most Egyptian copper alloy artefacts were cast into almost the final rough form, only requiring cleaning and minor work to bring them to their final form. Artefacts such as weapons however, required extensive work hardening to toughen the edges to their final useable form (Ogden 2000: 157). Lost wax casting is thought to have been used in Dynastic Egypt from the Old Kingdom onwards, and hence, the process used to form the arrowheads (see Appendix 5) is also applicable (Ogden 2000: 157, 158).

The Fifth Dynasty tomb of Wepemnofret at Giza shows what is a fairly early reference to annealing, the process by which the metal which has become hard through working is softened by heating (Ogden 2000: 155). This shows that the annealing process used in the manufacture of the arrowheads (see Appendix 5) was an appropriate step to take.

A5.1) ***Production of the Arrowheads***

> *Greatest thanks are to Stuart Davis and Martin Hughes, without whom the casting of the arrowheads could not have taken place. Davis produced the moulds, and both cast the bronze arrowheads at Hughes's foundry on the outskirts of Brighton. The author finished the rough-cast bronze arrowheads into the final form.*

An "average" arrowhead style was chosen for replication, and broadly based on a group of Late Bronze Age arrowheads from the site of Pella in Jordan and on the arrowheads from artefact group #370RR in the tomb of TutʿAnkhamūn. Two different weights of finished arrowheads were manufactured for this experiment, the six lighter arrowheads vary in weight from 15 to 17 grams each, with the overall average weigh of 15.83 grams, and the four heavier arrowheads varying in weight from 20 to 23 grams with an overall average weight of 21.25 grams. These two weights reflect the general two and three shekel weights of arrowheads in the ancient Mediterranean (see: Khalil 1980). The arrowheads consist of two blades to either side of a medial ridge which runs from the shoulder at the base of the blades to the tip of the arrowhead (Figs. 105a and 105b).

To enable bronze arrowhead blanks to be manufactured by casting, the first stage in the production was to make three wooden originals from which moulds would be made to cast the wax arrowhead blanks. These three wooden blanks were made from hardwood (Desert Ironwood [*Olneya tesota*] was chosen as it is easy to finish to an exceptionally smooth surface without the use of any added oils or varnishes, and because it was available to hand). Three sizes were made to eventually yield a variety of sizes of finished arrowheads (Fig. 106a). These wooden blanks were cut to rough shape with a fine coping saw and then finished to final shape with coarse and fine hand files, and polished with 220, 400, and finally 800 grit sandpaper. The tangs on these wooden blanks were left longer than the tangs on the finished arrowheads would be to provide extra material on the bronze blanks to be removed as necessary to enable matching the weights as best a possible. The wooden blanks were made to approximately 110% of the size desired in the final bronze blanks as the bronze itself shrinks approximately 10% as it solidifies from the molten state (Stuart Davis, pers. comm. 1999).

These wooden blanks were then sent to Stuart Davis in Brighton to prepare for casting. Davis proceeded to make the plaster moulds in which the wax blanks for the lost-wax casting of the bronze blanks would be made (Fig. 106b). These wax blanks were attached to a hemispherical wax base which would eventually form the cup of the mould (Fig. 106c) into which the molten bronze would be poured. Two wax cup-blocks were made with fifteen wax arrowhead blanks attached to one, and sixteen to the other. Stuart Davis then prepared these wax cup-block blanks (with wax arrowhead blanks attached) for casting by coating them with several layers of a graphite to make a smooth surface which would not bind with the molten bronze. After these layers were applied, having been allowed to dry between each application, a series of several layers of gypsum plaster slurry was applied over the graphite, again allowing each layer to dry before the next layer was applied (Fig 106c).

Prior to having Davis and Hughes cast the arrowheads in bronze, the wax had to be removed from the moulds. The method for removing the wax was to "flash" the mould with high heat, thus causing the was to quickly flow from the moulds. This process was done by heating a furnace made from a 45 gallon steel drum (lined with ceramic blanketing material) for 20 to 30 minutes until sufficient heat had been accumulated within the furnace (Fig. 107a). The hood of the furnace (the lined steel drum) was lifted via and attached overhead pulley system and held out of the way while the wax-filled moulds were placed upside-down upon the furnace base, both resting upon several fire-bricks (Fig. 107b). The hood was then lowered into position and the heat reapplied. This process of quickly placing the moulds into the heat allows the wax to melt very quickly and allow the moulds to expand without the wax within expanding at a differential rate thereby cracking the moulds. Within moments the wax began to flow free from within the upturned moulds, catching fire as it poured from the moulds (Fig. 108). This process quickly emptied the moulds of all wax, at which time the torch was extinguished and the moulds allowed to cool slowly cool within the furnace which prevented the moulds from cooling too quickly and cracking. Upon removing the moulds from the furnace it was discovered that a few of the individual arrowhead sections had broken away or cracked. The moulds were then coated with a further layer of the plaster slurry to seal this damage to prevent leakage during casting.

While the secondary coating of the slurry was left to dry, the foundry furnace was prepared for melting the bronze. The base of the furnace was made of the lower quarter of a 45 gallon steel drum set into a base of sand and ringed with concrete blocks. The hood of the furnace was made of the remaining three-quarters of the drum with a vent cut into the top. Both the base and the hood of the furnace were lined with ceramic blanket material to retain the heat (Fig. 109a). A small port some 70 to 80mm square was cut into the lower rear edge of the furnace hood into which the torch pipe was placed. The butane torch, much the same as the one used with the first furnace to flash the wax from the moulds, was fitted with a Y-joint into which the tube from the blower was connected. At this point the moulds were partially buried in the sand casting-pit next to the furnace (Fig. 109b).

The crucible was partly filled with pieces of reclaimed gunmetal bronze (88% copper, 10% tin, 2% zinc) and placed into the furnace. The hood was lowered into place, the torch lit and placed into the port at the lower edge of the furnace hood. The blower was turned on at this point to increase the air flow into the furnace thereby increasing the temperature. After some 20 to 30 minutes, the torch was extinguished and the hood lifted and swung out of the way and more bronze was added to the crucible. The hood was lowered and the torch and blower assembly re-positioned.

After a further 20 to 30 minutes, when the bronze was molten and judged to be at the proper temperature, the hood was lifted and swung out of the way. The glowing crucible was grasped with the two-man tongs (manipulated by Davis and Hughes) and placed in a cradle (Figs. 110a and 110b). The cradle was then tilted to approximately 45° and a tool used to scoop the slag from the surface of the molten bronze thereby removing impurities which would cause faults in the finished arrowheads. The crucible was then positioned over the casting pit and the molten gunmetal bronze was poured into the moulds (Fig. 111). The moulds were filled until the cups were full, the weight of the molten bronze forcing the bronze down into the arrowhead cavities. The moulds were then left in the sand of the casting pit until they had been cooled sufficiently to enable handling.

When the bronze-filled moulds had cooled somewhat, they were removed from the casting-pit and quenched in a large tub of water. The plaster mould material was then broken away from the bronze casts with light blows from a small hammer. When fully cooled, the arrowheads were sawn from the bronze block formed within the casting cup with an electric grinder. Some of the arrowhead cavities did not fill with bronze, while others had only partially filled, the forward point of the arrowhead remaining empty. Some of the other arrowhead cavities had filled to the tip of the arrowhead, but gas pockets within the arrowhead ended up making these arrowheads unsuitable to form into finished arrowheads. All but one of the smallest (and thinnest) of the three sizes of arrowhead blanks were unsuitable to be formed into finished arrowheads due to the gas pockets. The single suitable blank was the first arrowhead to be taken to completion and was retained as a spare.

Seven stages were employed to finish the rough-cast bronze blanks into suitable arrowheads for use in the experiment (Fig. 112). The first stage involved trimming the tang of the arrowhead to the longest possible length by removing the excess bronze where the original wax arrowhead blank was joined to the wax block which formed the casting cup. A stationary electric belt sander was used to trim the excess metal from the mould-lines all along the edges of the arrowhead blanks. The second stage involved placing the tang of the arrowhead into a bench vise to hold it steady while a coarse file was used to reduce the thickness of the blade thereby reducing the amount of overall cold hammering that would be used in later stages. The resulting cross section of the blade of an arrowhead would be that of a flattened hexagon (Fig. 112b). In most cases some excess bronze was removed from the tang of the arrowhead, leaving a square cross-section to the tang at a 45° angle to the face of the blade of the arrowhead. This, as with the blade, was done to reduce the amount of cold hammering required to finish the arrowhead.

The third stage was to cold hammer the entire blade of the arrowhead relatively flat, leaving the shoulder of the blade mostly untouched. This was accomplished by placing the arrowhead, hand held, upon an anvil and working both sides flat with a 22 oz.(625 grams) hammer (Fig. 112c). The second part of stage three was to elongate and shape the tang of the arrowhead. This was done by holding the arrowhead on the anvil and working four sides into the tang with a 16 oz. (454 grams) hammer, elongating the tang in the process by striking the tang with blows pushing the metal towards the distal end of the tang, rotating the tang 90° after every two or three blows (Fig. 113 shows the deformation of the metal during hammering). After this initial stage of cold hammering, the arrowhead was taken to another section of the workshop where it was annealed. The arrowheads were annealed with an oxygen-acetylene torch, adjusted to provide a low blue flame, heating the entire arrowhead up to a dull red heat after which it was allowed to air-cool for some 20 to 30 minutes.

The fourth stage involved hammering the edges into the blade of the arrowhead. This was done by placing the blade of the arrowhead on the anvil (hand held) and using the ball end of a 16 oz. ball-peen hammer to strike blows outwards towards the edge of the blade, stretching the metal and leaving a central rib of softer annealed metal running down the length of the blade (Fig. 112d). After every four or five blows, the arrowhead would be turned over and hammered from the other side to prevent the blade from taking an overall triangular cross-section. Several blows would be made to either side of one edge of the blade of the arrowhead, and then repeated on the other edge so as to prevent the arrowhead from bending laterally and developing stress fractures across the softer central rib. In some instances, these stress fractures, perpendicular to the length of the arrowhead, did develop, but during the testing of them at the Royal Armouries Museum in Leeds, did not prove to decrease the performance of the arrowheads. After this session of cold hammering, if an arrowhead had been struck a large number of times, it was judged best to anneal the arrowhead again before resuming the cold hammering in shaping the blades. It was not found to be necessary to do this to all the arrowheads as the author did, during the process of shaping the arrowheads, learn to economise the number of blows struck (and place them more accurately) thereby somewhat increasing the rate of production.

The fifth stage of production was to work the blades of the arrowhead down to an even length, width and breadth by using a fine hand file, the proximal end of which had been sharpened to provide a metal-working plane. This squared and sharpened end of the file was used to "carve" the surface of the blades down and used, in combination with the surface of the file, to achieve a relatively smooth surface. A series of four lines, two on either side of the blade, were cut with the edge of the file, delineating the total width of the central rib, thereby forming a shoulder against which to run the length of the tool (Fig. 112e). The central rib on both sides of each arrowhead, left in the annealed state, provides a central core of softer, malleable material to counteract the very hard cold hammered blades of the arrowhead. This variation in the hardness of the various sections of the arrowhead allow for an arrowhead that will both hold a sharp edge in use, and yet not break upon impact (Fig. 112f).

The sixth stage of production (Fig. 112f) was to trim the total width of the arrowhead to a suitable measurement, reducing the thickness of the blades and forming a sharp edge. The fifth and sixth stages were by far the most time-consuming stages in the production of the arrowheads as the two blades on each arrowhead had to be formed as close to identical as possible to ensure that the arrowhead would be balanced, thereby ensuring that the finished arrow would fly straight and true.

The seventh stage involved two processes. The first was to file the tang of the arrowhead down to an even square cross-section, the distance across the points of the cross-section matching the thickness of the arrowhead at the shoulder (Fig. 112g). If necessary, the tangs were then filed into an octagonal cross-section so as to fit into the 4.2mm and 4.0mm (for large and small arrowheads respectively) sockets at the proximal end of the foreshafts of the arrows (the construction of which will be discussed below). The second step was to sharpen the edges of the blades with an emery sharpening stone (and water) prior to mounting the arrowheads into the foreshafts.

A5.2) ***Production of the Arrows***

The replicated Late Bronze Age arrows used in this experiment are a reasonably close replication of Item #370RR (30 footed reed arrows) in the tomb of TutʿAnkhamūn (Fig. 114, see also: McLeod 1982: 19-20). This group of artifacts was chosen as the basis for replication as they are directly contemporary with the cuirass of alum-tawed leather scales also found in TutʿAnkhamūn's tomb, and it is a section of this armour that was replicated in modern alum-tawed leather. As well, being a group of thirty arrows, it shows that they were a common form (other very similar arrows were also found in the tomb), and that the particular measurements of the arrows are represented in thirty specimens, all in a group, shows that any given measurement is not a statistical exception.

The shafts of the reed arrows in Tutʿ Ankhamūn's tomb have been identified as the aerial stems of *Phragmites communis*, the common water reed (McLeod 1982: 54) found in riverine environments in much of the world, the differences in the reed from geographical location not being of any great significance. A search for suitable common water reeds in England was not successful, so three and four foot long sections of common bamboo (from a garden centre) were purchased as the closest alternative. Approximately twenty of the sections purchased were, upon close examination, deemed suitable to shape into arrow shafts based upon several criteria: a) a similar overall stiffness (spine) of each three-foot length, b) a similar diameter, c) relative lack of obvious damage during harvesting, d) lack of insect damage, and e) a relative degree of straightness.

Prior to shaping the selected bamboo shafts, it was decided that the finished arrow should fly in the direction of original growth of the plant, that is, the fore-most end of the arrow (with the hardwood foot and bronze arrowhead) should be the end of the original shaft that, in the original growth of the bamboo, was furthest from the ground. This is the manner in which the arrows from Tutʿ Ankhamūn's tomb were made (McLeod 1982: 53-55).

The first stage in the production of the arrows involved trimming each of the shafts at 20 mm from the rear-most growth node. This small amount of excess material behind the node was left to strengthen the nock of the shaft (the nock being the notch into which the bowstring will fit upon using the arrows), helping to prevent the shaft splitting upon use from the force of the arrow being pushed by the bowstring. The shafts were then hand straightened without the use of heat as they were still moist enough from being stored out of doors at the garden centre. The shafts were relatively flexible and would hold the corrective bend.

Most of the arrows found in the tomb of Tutʿ Ankhamūn had nocks fashioned from hardwood, many of which were ebony, as well as ivory or bone, and a few of black horn (McLeod 1982: 54). To save time and effort in the manufacture of the arrows for the experiment, self nocks were cut into the material of the shaft itself. This deviation from the form of the pattern of Tutʿ Ankhamūn's arrows would not affect the performance of the shaft in flight or upon striking the intended target. The use of hardwood nocks inserted into the nock-end of the arrow shafts by New Kingdom Egyptian arrow smiths and fletchers was likely to prevent undue splitting of the reed shafts , but as the bamboo used to replicate the arrows for this experiment was somewhat thicker, it was not deemed necessary to follow this example, as the bamboo would be strong enough by itself for the tests. It is possible that intensive use of the replicated arrows would eventually result in the nock-end of a shaft splitting, but the relatively few shots needed for the experiment did not prove to be sufficient to split even one shaft. The nocks themselves were fashioned by rounding the end in one plane (Fig. 115) and then cutting a notch with a thin flat file to a depth of 5.0mm and width of 3.0mm. The squared bottom of the notch was then rounded, smoothed, and continued to the parallel sides of the shaft with a round needle-file to a total average depth of 7.0mm.

Following the forming of the nocks, the growth nodes of each shaft were filed down to be flush with the main length of the shaft using a fine flat file. The filed nodes were then smoothed down using a medium grit sandpaper (approximately 80 to 100 grit) and the whole shaft was then finished with 360 grit emery sandpaper to provide a smooth surface. The shafts were then sprayed with an artists varnish (*Daler-Rowney "Artists' Clear Picture Varnish"*) help to seal out the moisture of the temperate English environment. After the application of the varnish the arrows were left to dry for several days. It is not evident that any finish to the main length of arrow shafts were used in the ancient world, but was deemed justifiable in this experiment to help prevent the shafts from warping from changes in humidity and temperature.

The shafts, when the varnish was dry, were then cut to a total length of 760mm. The exposed length of the foreshafts (the length minus the tang) of all the footed arrows in the tomb of TutʿAnkhamūn averaged out at 105mm, and the foreshafts for this experiment were cut to 110mm to accommodate the author's slightly longer average draw-length (845mm in Mediterranean draw [to the ear]). The total length of the arrow shafts, including the foreshaft, used in this experiment is 870mm, which is within the bounds of the lengths of the arrows found in the tomb of TutʿAnkhamūn.

The group of arrows (artefact #370RR) in TutʿAnkhamūn's tomb upon which the replica arrows were based were fletched with four feather flights oriented at 45°, 135°, 225°, and 315°

from the cut of the nock. It is, however, equally common for other groups of arrows from Tutʿankhamūn's tomb to be fletched at angles of 0°, 90°, 180°, and 270° to the cut of the nock. McLeod (1982:60) suggests that the nocks in these arrows may have rotated in the shafts at some time over the last many centuries. The angle of fletching chosen was the former (45°, 135°, 225°, and 315°), and would provide the least resistance upon releasing a drawn arrow from the bow as two flights would have to bend slightly as the arrow passes the handle of the bow rather than a deep compression of one flight. This aids the recovery of the arrow from the Archer's Paradox (the arrow having to bend around the grip of the bow upon release and return to a true, straight flight). Left-wing full length turkey feathers were purchased from *Eagle Classic Archery* (Worksop, England) and cut to shape. A simple, basically triangular, shape was chosen, with the forward half of the leading edge (the cut edge of the feather) curving slightly to the base of the feather (Fig. 116). The flights were cut to be as similar to those found on the arrows in the tomb of Tutʿankhamūn as possible. The feather flights on the arrows in Tutʿankhamūn's tomb are all in very poor condition, the base of the feather often being the only indication that the arrows had ever been fletched. A few arrows retained some of the original fletching, and the flights used in this experiment were based upon these examples. The flights for this experiment were cut to a total 147mm (5 $^3/_4$ inches) in length with a total of 133mm (5 $^1/_4$ inches) of quills extant with 7mm ($^1/_4$ inch) of the base of the feather left bare both at front and rear of the feather to facilitate tying the flight to the arrow shaft. The total height of the flights are 17.5mm ($\pm$ 1mm) at the rear of the quills of the flight.

Each flight was placed between the jaws of a fletching jig and a thin bead of adhesive (*Evo-Stick Multi-Purpose Clear Adhesive*, a common modern adhesive for fletching arrows) was run along the inner edge of the base of the feather. The shaft was then aligned at 45° to the cut of the nock and placed in the groove at the top of the jig and tied into place. The shaft was left tied to the jig for at least an hour to allow the adhesive to set before being removed. This process was repeated until each of the ten shafts had a single flight attached. The same procedure was used to attach the second flight at 180° to the first on each shaft, again fletching each shaft with the second feather before proceeding to the third and fourth flights (which were glued in place at 90° to the first two, one on either side), allowing the adhesive to set between each stage of the process.

After glueing four flights onto each shaft, each shaft was then in turn tied into the fletching jig (just to the forward end of the flights) which served as a base in which to rotate the shaft. Each shaft in turn then had a drop of carpenter's white wood glue (*Bond-It* woodworker's adhesive) placed just forward of the cut of the nock and smoothed around the diameter of the arrow shaft. Then a length of heavy-weight cotton-polyester thread was served around the shaft for a distance of 15mm (on average) along the shaft to strengthen the nock. After tying off the thread, a second drop of glue was applied to the surface of the thread and smoothed around the diameter, with any excess on the shaft itself being wiped off. Each shaft was treated thus and left for at least two hours to allow the glue to set.

Each shaft was then, in turn, tied into the groove of the fletching jig for the next process. A small drop of white glue (as above) was placed at the rearward end of the fletching and smoothed around the diameter of the shaft over the 7mm excess at the end of each flight. The rearward end of the flights were then tied onto the shafts with a thin cotton-polyester thread in the same manner as for the reinforcement of the nocks as described above. After tying off the thread, another drop of white wood glue on the surface of the thread and smoothed around the diameter of the covered shaft, wiping off any excess not covering the serving. This same process was applied to the forward end of the flights before proceeding on to the next arrow.

A5.3) *The Arrowhead/Foreshaft Assembly*

The arrowhead/foreshaft assemblies are composed of two parts: the arrowhead and the wooden foreshaft, glued together and reinforced with thread and glue (Fig. 117). The forward (arrowhead) end of the shaft was the prepared for the insertion of the foreshaft by running a small round needle-file in and out of the pith-filled core of the bamboo. The foreshafts were formed of ramin hardwood dowelling (7.3mm diameter) and modern Pine arrow shaft material (8.4mm). A length of dowelling or arrow-shafting was taken and 110mm marked out which would form the exposed length of the foreshaft. The remaining material, ranging from 54mm to 72mm was then reduced in diameter with a knife and finished with a fine flat file, the last centimetre or two tapering to a point. The diameter of the tangs of the foreshafts were matched to the diameter of the hollow of the bamboo shafts providing a snug fit. This resulted in each foreshaft being matched to a specific arrow shaft. The foreshafts and arrow shafts were numbered to prevent the incorrect foreshaft from being associated with a given arrow. The variation of the length of the tang of the foreshaft was deemed to be of no noticeable significance in the performance of the finished arrows when they were used in the experiment.

The foreshafts were taken to the University of Durham Chemistry department workshops where they were placed into a precision lathe and drilled to accept the insertion of the tangs of the bronze arrowheads. The sockets drilled into the foreshafts were 4.2mm in diameter for arrows #1 to #4, and 4.0mm in diameter for arrows #5 to #10. This was to accept the slightly larger tang diameter of the larger arrowheads used on arrows #1 to #4. The tangs of the arrowheads were then individually reduced to fit the sockets in the foreshafts. When matched, the arrowheads were inserted into the foreshafts and visually checked for straightness. Any arrowhead/foreshaft pair that were noticeably out of true were then separated and the tang of the arrowhead bent to correct this. Upon reassembly, all ten of the pairs were then spin-tested for balance. This was done one at a time by placing the assembled pair with the point of the arrowhead placed on the flat surface of the paper of a notebook with the assembled unit being held vertically by lightly holding the point of the tang of the wooden foreshaft with a finger-tip. A fast spin was then imparted (by hand) to the whole assembly. Any deviation from true balance can then be identified visually and by feel, where it is felt in the finger stabilizing the assembly during the test. Using this manner it is very easy to determine if the arrowhead/foreshaft assembly is straight. With any of the assembled arrowhead/foreshaft units that were out of true, the arrowhead was removed, the tang again bent to correct for balance, and reassembled and spin-tested. This process was used until all the assembled units were properly balanced. The socketed ends of the foreshafts were then marked as to orientation of the blades of the arrowhead, and the arrowheads removed. A small drop of carpenter's white wood glue (*"Bond-It"* woodworkers adhesive) was placed into the bore of each socket and the arrowhead replaced according to the alignment marks (any excess glue being wiped off), and the reassembled unit spin tested a final time. Due to care taken in the initial spin testing, further adjustments were not necessary.

When the glue had set in arrowhead/foreshaft units, each unit was then inserted into the matched arrow shaft and spin tested by placing the point of the arrowhead on the paper of a notebook while holding the shaft stable, but without restricting the hand-imparted spin. The arrowhead/foreshaft assembly and arrow shaft were then marked as to orientation, and the Arrowhead/foreshaft assembly removed. A small drop of carpenters white wood glue was then placed on the tang of the foreshaft next to the shoulder and smoothed around the diameter of the tang to a distance of no more than 20mm along the shaft. The assembly was then inserted into the arrow shaft and the orientation marks lined up. The assembled arrows were then left laying flat for at least 24 hours to allow the glue to dry.

Each of the assembled arrows were then, one by one, placed into the groove of the fletching jig at the balance point midway down the arrow shaft and tied in place. A drop of white carpenters glue was then placed on the forward end of the foreshaft, directly behind the shoulder of the arrowhead. This drop of glue was smoothed around the diameter of the foreshaft to for approximately 30mm. This area of the foreshaft was then served with a thin cotton-polyester thread to an average distance (over all ten arrows) of 23mm. A second drop of white carpenters glue was then applied to the thread and smoothed over it. The join between the arrow shaft and the tang end of the arrowhead/foreshaft assembly was then served in exactly the same manner with the thread covering an average of 27mm in length, the middle of which being directly over the join of arrow shaft to arrowhead/foreshaft assembly. At this point the construction of the replica Egyptian arrows was finished.

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Table 1

Group	Source	Number of Scales		Weight (kg)
Kamid el-Loz Armour From: Ventzke 1986: 174, 176, 178	Ventzke's Type A	Type I scales	91	0.8436
		Type II scales	572	4.7876
		Type VII scales	77	0.7908
		Type IX scales	576	1.0195
		TOTAL	**1316**	**7.4415**
	Ventzke's Type B	Type I scales	91	0.8436
		Type II scales	572	4.7876
		Type VII scales	77	0.7908
		Type IX scales	1267	2.2426
		TOTAL	**2007**	**8.6646**
	Ventzke's Type C	Type I scales	795	7.3511
		Type II scales	572	4.7876
		Type VII scales	95	0.9756
		Type IX scales	1267	2.2426
		TOTAL	**2729**	**15.3569**
	Ventzke's Type D	Type I scales	1344	12.4589
		Type II scales	572	4.7876
		Type VII scales	120	12.324
		Type IX scales	1267	22.426
		TOTAL	**3303**	**20.7215**
Nuzi Armour From: Kendall 1974: 277-278	Nuzi Text: HSS XV 9	Large Scales	400	13.62
		Small Scales	279	3.33
		TOTAL	**679**	**16.95**
	Nuzi Text: HSS XV 3:2f	Large Scales	400	13.62
		Small Scales	280	3.34
		TOTAL	**680**	**16.96**
	Nuzi Text: HSS XV 3:28f	Large Scales	435	14.76
		Small Scales	312	3.72
		TOTAL	**747**	**18.48**
	Nuzi Text: HSS XV 5:10f	Large Scales	560	18.48
		Small Scales	160	1.91
		TOTAL	**720**	**20.39**
	Nuzi Text: HSS XV 3:18f	Large Scales	500	16.48
		Small Scales	360	4.31
		TOTAL	**860**	**20.79**
	Nuzi Text: HSS XV 5:1f	Large Scales	500	16.48
		Small Scales	500	5.99
		TOTAL	**1000**	**22.47**
	Nuzi Text: HSS XV 3:11f	Large Scales	598	19.70
		Small Scales	540	6.45
		TOTAL	**1138**	**26.15**

Numbers of Scales and Hypothetical Weights for Coats of Armour from Nuzi and Kamid el-Loz

Adapted from: Ventzke 1986: 174, 176, 178, Kendall 1974: 277-278

Table 2

Replica Section of Armour	Weight of Armour Scales	Weight of Textile Backing	Total Weight
Rawhide Scale armour 250 Rawhide Scales	0.486 kg	0.091 kg	0.577 kg
Composite Scale Armour 125 Bronze Scales 125 Rawhide Scales	1.727 kg	0.091 kg	1.818 kg
Bronze Scale Armour 250 Bronze Scales	2.967 kg	0.091 kg	3.058 kg

Table showing the weights of the replica sections of scale armour

Table 3a

Armour	Shot Number	Arrow Point Type	Penetration in millimetres	Specific Damages
Sea Peoples Waxed Leather Armour Archer: Thomas Hulit Draw Length: 845mm (33.25 in.)	1	Ebony Point	44	No damage to arrow.
	2	Bronze Point (arrow #10)	120	No damage to arrow.
	3	McEwen's Bronze Point	69	No damage to arrow.
Alum-tawed Leather Scale Armour Archer: Thomas Hulit Draw Length: 845mm (33.25 in.)	4	Ebony Point	0	Slight compression and bending of two leather scales. No damage to arrow.
	5	Ebony Point	0	Slight compression and bending of two armour scales, and abrasion to surface of the linen backing. No damage to arrow.
	6	Bronze Point (arrow #10)	129	Clean cut through two scales and the linen backing. No damage to arrow.
	7	McEwen's Bronze Point	0	Deep conical depression in the armour scale. No penetration. No damage to the arrow.
	8	McEwen's Bronze Point	2	Deep compression and 2mm penetration of the armour scale. No damage to linen backing. No damage to the arrow.
Bronze Scale Armour Archer: Thomas Hulit Draw Length: 845mm (33.25 in.)	9	Ebony Point	0	Moderate damage to tip of the ebony point. 1 bronze scale torn away from the armour.
	10	Bronze Point (arrow #10)	0	The tip of the point curled a full turn, and the foreshaft broken away from the arrow. One armour scale was slightly bent.
	11	Bronze Point (arrow #7)	0	Partial curl to the bronze point. Point and foreshaft both broken away from the arrow. One scale bent and torn off the armour.
	12	McEwen's Bronze Point	0	Bronze point slightly dulled. One scale bent and torn off the armour.
	13	McEwen's Bronze Point	0	Bronze point slightly dulled. Several scales bent, and one scale bent and torn off the armour.

Table 1a: Tabulation of the results of the experiments at H.M. The Royal Armouries Museum. Shots 1 to 13.

Table 3b

Target / Archer	Shot Number	Arrow Point Type	Penetration in millimetres	Specific Damages	Video File and Image
Un-armoured Target Archer: Thomas Hulit; Draw Length: 745mm (29.33 in.)	14	Ebony Point	27	No damage to arrow.	SHOT_14.m1v
	15	McEwen's Bronze Point	52	No damage to arrow.	SHOT_15.m1v
	16	Bronze Point (arrow #8)	96	No damage to arrow.	SHOT_16.m1v
	17	Bronze Point (arrow #8)	126	No damage to arrow.	SHOT_17.m1v
Rawhide Scale Armour Archer: Thomas Hulit; Draw Length: 745mm (29.33 in.)	18	Ebony Point	0	No damage to arrow.	SHOT_18.m1v Shot_18_sequence.jpg
	19	McEwen's Bronze Point	15	No damage to arrow.	SHOT_19.m1v
	20	Bronze Point (arrow #8)	63	Foreshaft broken off of arrow at the foot, no damage to the bronze point.	SHOT_20.m1v Shot_20_sequence.jpg
Composite Bronze and Rawhide Scale Armour Archer: Thomas Hulit; Draw Length: 745mm (29.33 in.)	21	Ebony Point	0	Ebony point broken off of the arrow.	SHOT_21.m1v Shot_21_sequence.jpg
	22	McEwen's Bronze Point	0	No damage to arrow.	SHOT_22.avi Shot_22_Zoom_In.m1v Shot_22_sequence.jpg
	23	Bronze Point (arrow #5)	0	Bronze point bent and broken off of the foreshaft. Some scales slightly bent.	SHOT_23.m1v

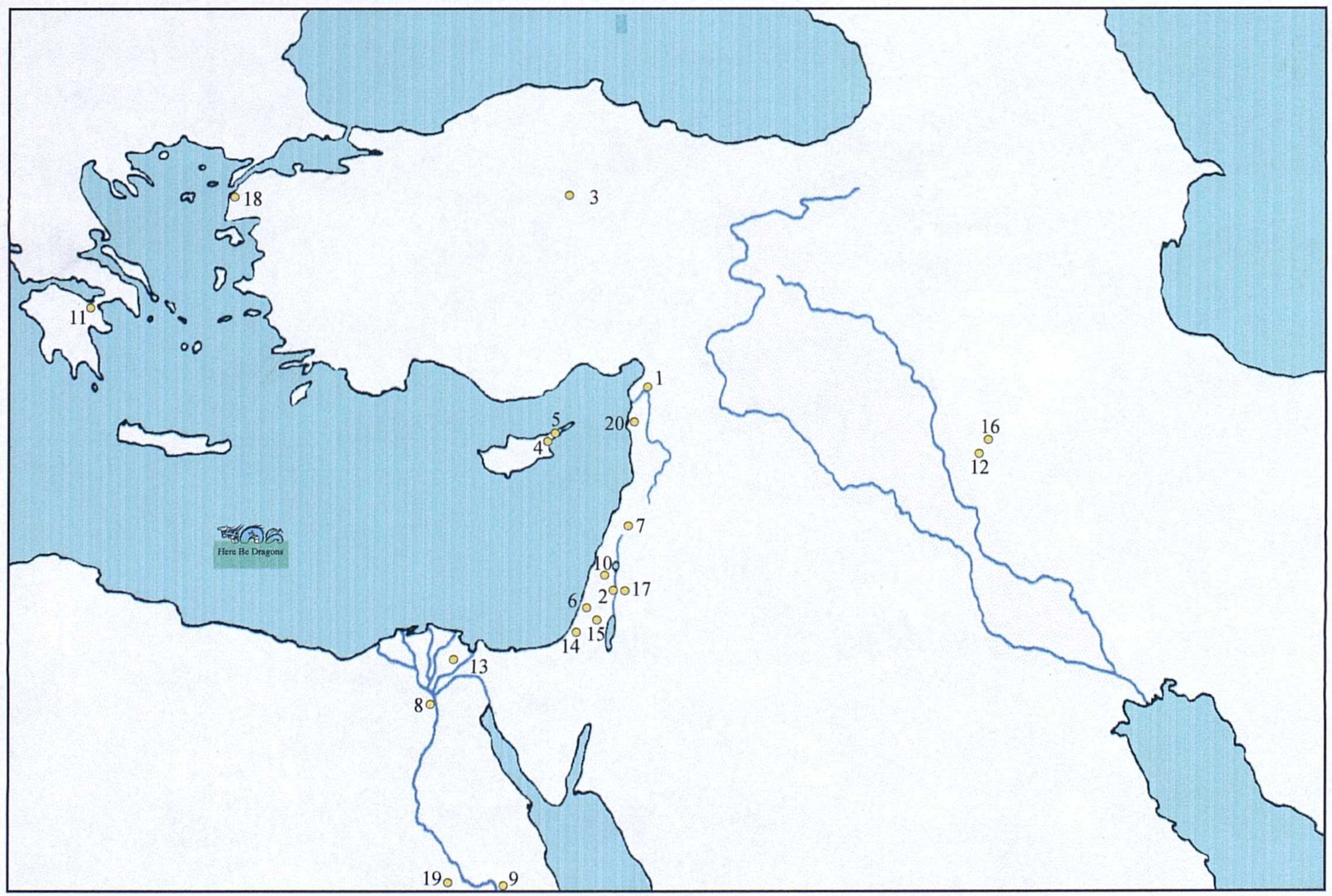
Table 1b: Tabulation of the results of the experiments at H.M. The Royal Armouries Museum. Shots 14 to 23.

Table 3c

Target / Archer / Draw Length	Shot Number	Arrow Point Type	Penetration in millimetres	Specific Damages	Video File and Image
Rawhide Scale Armour Archer: Andrew Bodley Draw Length: 845mm (33.25 in.)	24	Ebony Point	40	No damage to arrow.	SHOT_24.m1v
	25	McEwen's Bronze Point	70	No damage to arrow. Deep penetration as the arrow passed through the same hole as shot #24..	SHOT_25.m1v
	26	McEwen's Bronze Point	7	No damage to arrow.	SHOT_26.m1v
	27	Bronze Point (arrow #6)	98	No damage to arrow.	SHOT_27.m1v
Composite Bronze and Rawhide Scale Armour Archer: Andrew Bodley Draw Length: 845mm (33.25 in.)	28	Ebony Point	0	Slight damage to tip of the ebony point. 2 rawhide scales and 1 bronze scale torn away from the armour.	SHOT_28.m1v Shot_28_sequence.jpg
	29	McEwen's Bronze Point	0	No damage to arrow. 1 bronze scale torn away from the armour.	SHOT_29.m1v Shot_29_sequence.jpg
	30	Bronze Point (arrow #6)	0	Bronze point deeply curved at the point, but foreshaft and point not broken from the arrow. Bronze armour scales bent. Zoom-In clip shows damage of more than one shot.	SHOT_30.m1v Shot_30_Zoom_In.m1v
Un-armoured Target Archer: Andrew Bodley Draw Length: 845mm (33.25 in.)	31	McEwen's Bronze Point	128	No damage to arrow.	SHOT_31.m1v
	32	Bronze Point (arrow #9)	202	Foreshaft broken off in target.	SHOT_32.m1v
	33	Ebony Point	98	No damage to arrow.	SHOT_33.m1v

Table 1c: Tabulation of the results of the experiments at H.M. The Royal Armouries Museum. Shots 24 to 33.

Map 1

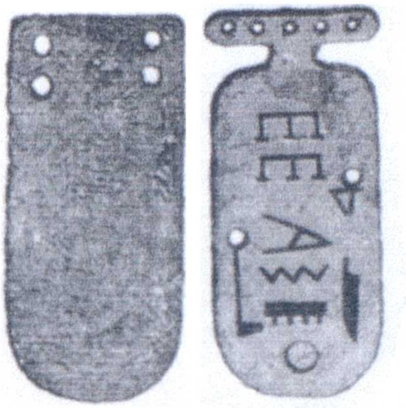


1. Alalakh
2. Beth Shan
3. Boğazköy
4. Enkomi
5. Gastria-Alaas
6. Gezer
7. Kāmid el-Lōz
8. Lisht
9. Malqata
10. Megiddo
11. Mycenae
12. Nuzi
13. Pi-Ramesse
14. Tel el-ʿAjjul
15. Tel el-Faraʿh South
16. Tell al-Fakhar
17. Tell Deir Alla
18. Troy
19. Tutʿankhamūn
20. Ugarit

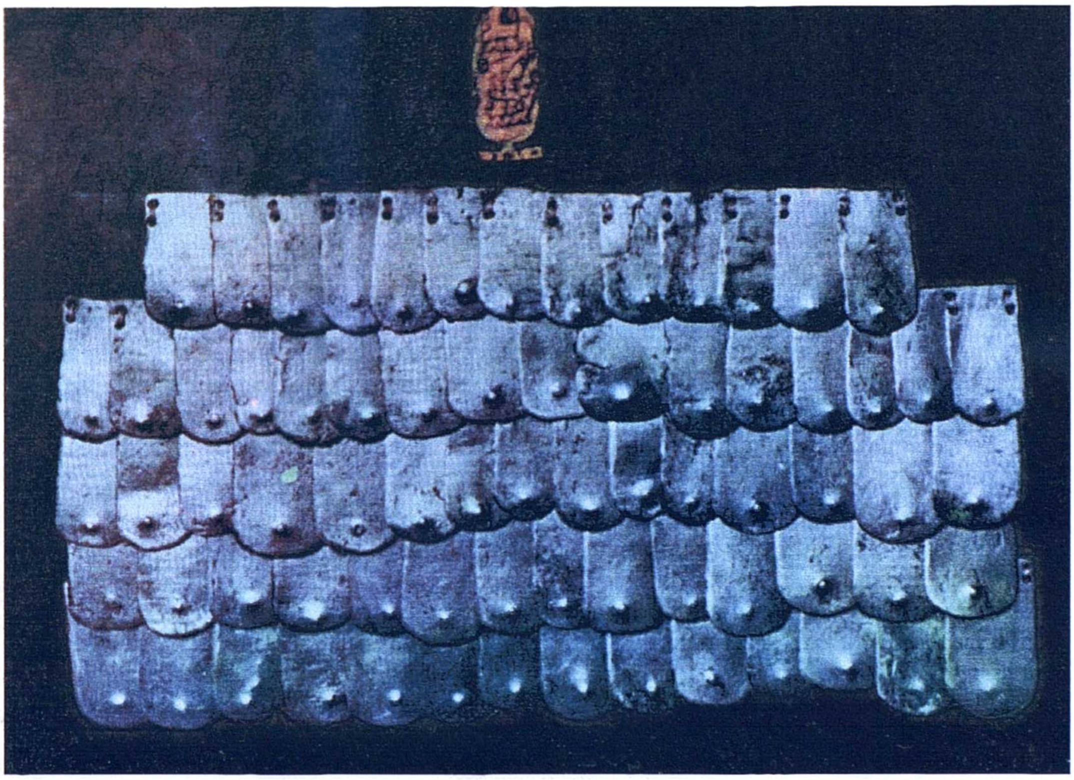
Map of the Eastern Mediterranean and Middle East showing sites at which armour scales have been found

Adapted from: Karageorghis and Masson 1975: 222, Fig. 22

Fig. 1



A: Two scales attributed to the pharaoh Shoshenq



B

Scale armour attributed to Pharaoh Shoshenq

A from: Wilkinson 1878: 221
B from: Yadin 1963: 354

Fig. 2

Textile armour with decoration of lions depicted in the tomb of Ramses III

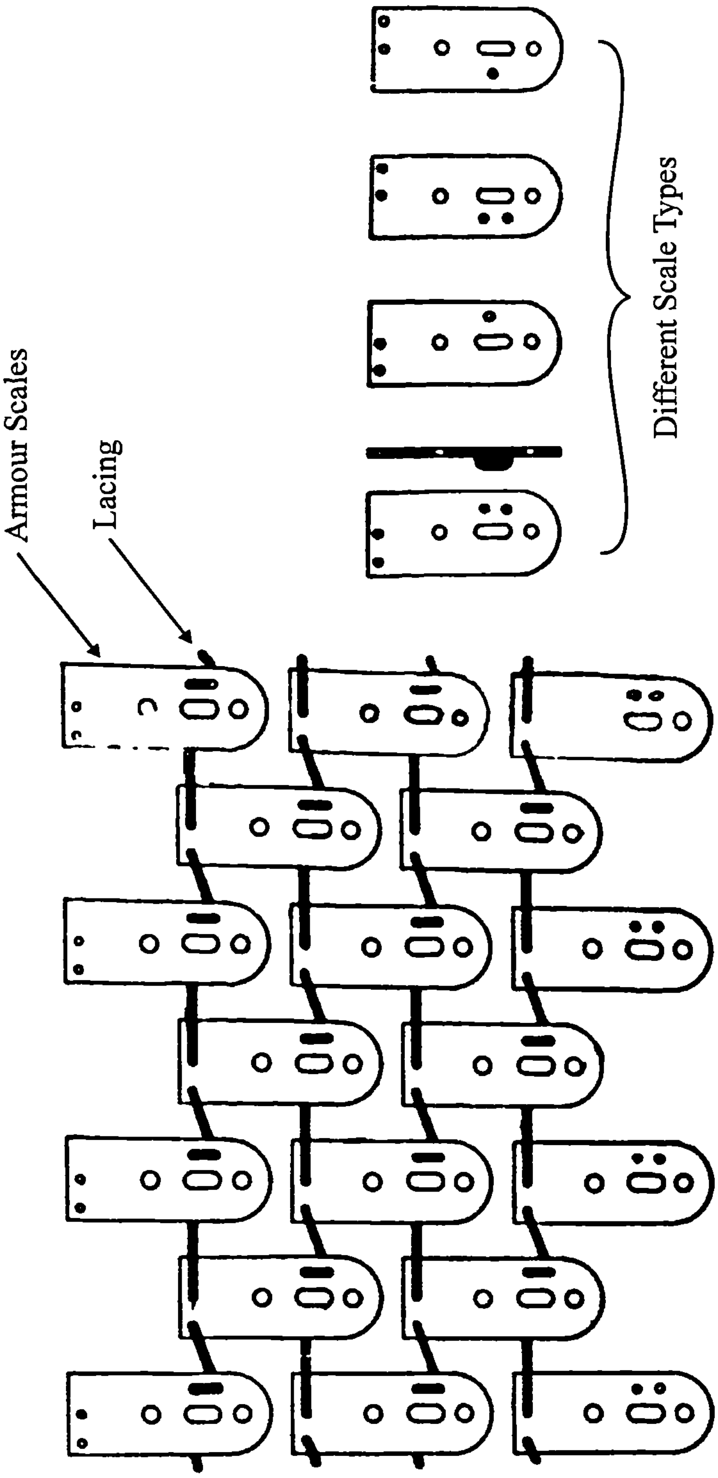
From: Wilkinson 1878: 220

Fig. 3

Captured soldiers depicted in the reliefs at Medinet Habu
The central soldier wears textile "armour" to the breast

From: Breasted 1932: Pl. 100

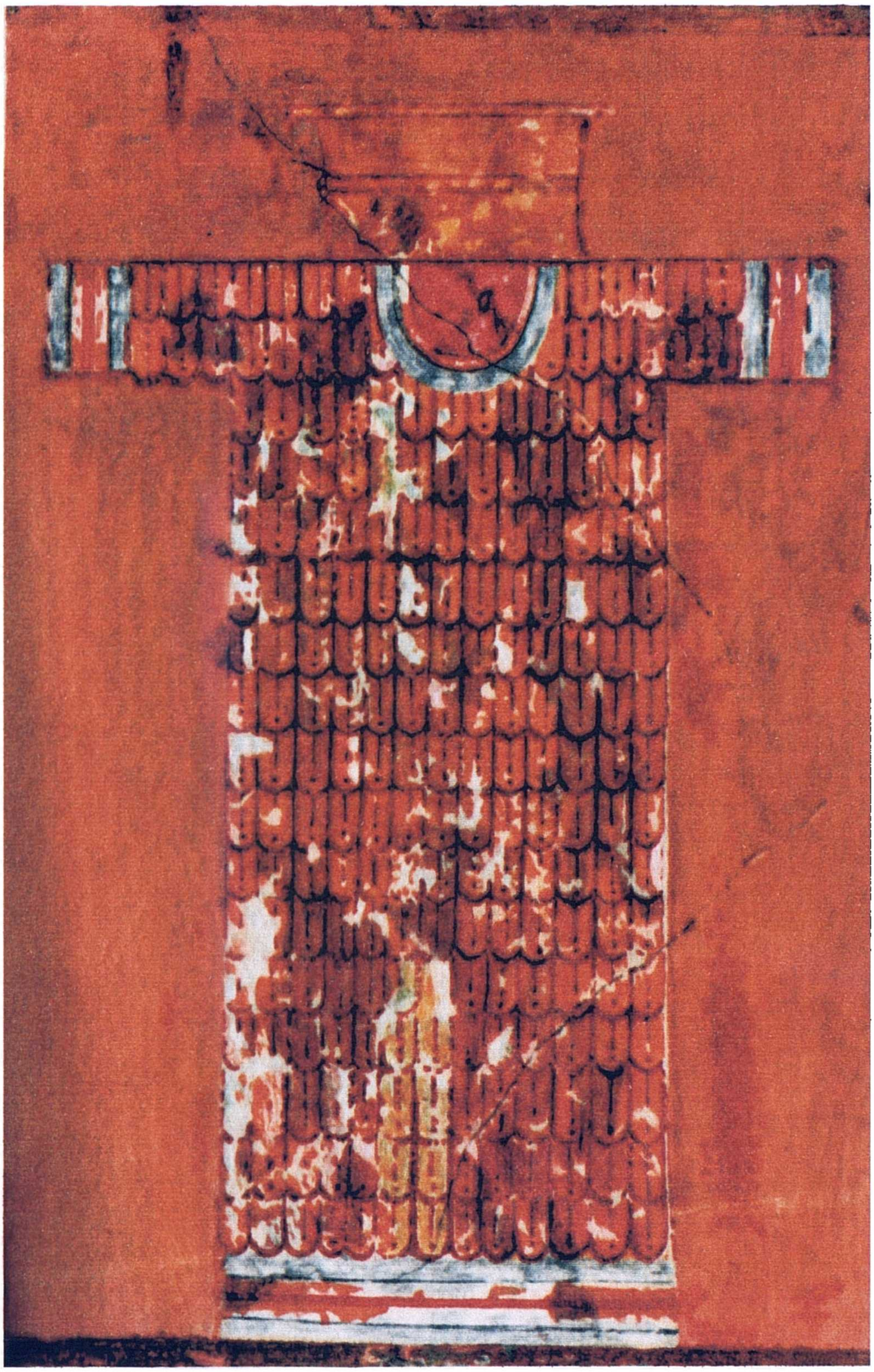
Fig. 4



Suggestion for lacing Cypriot Iron Age style armour scales

From: Yadin 1963: 14

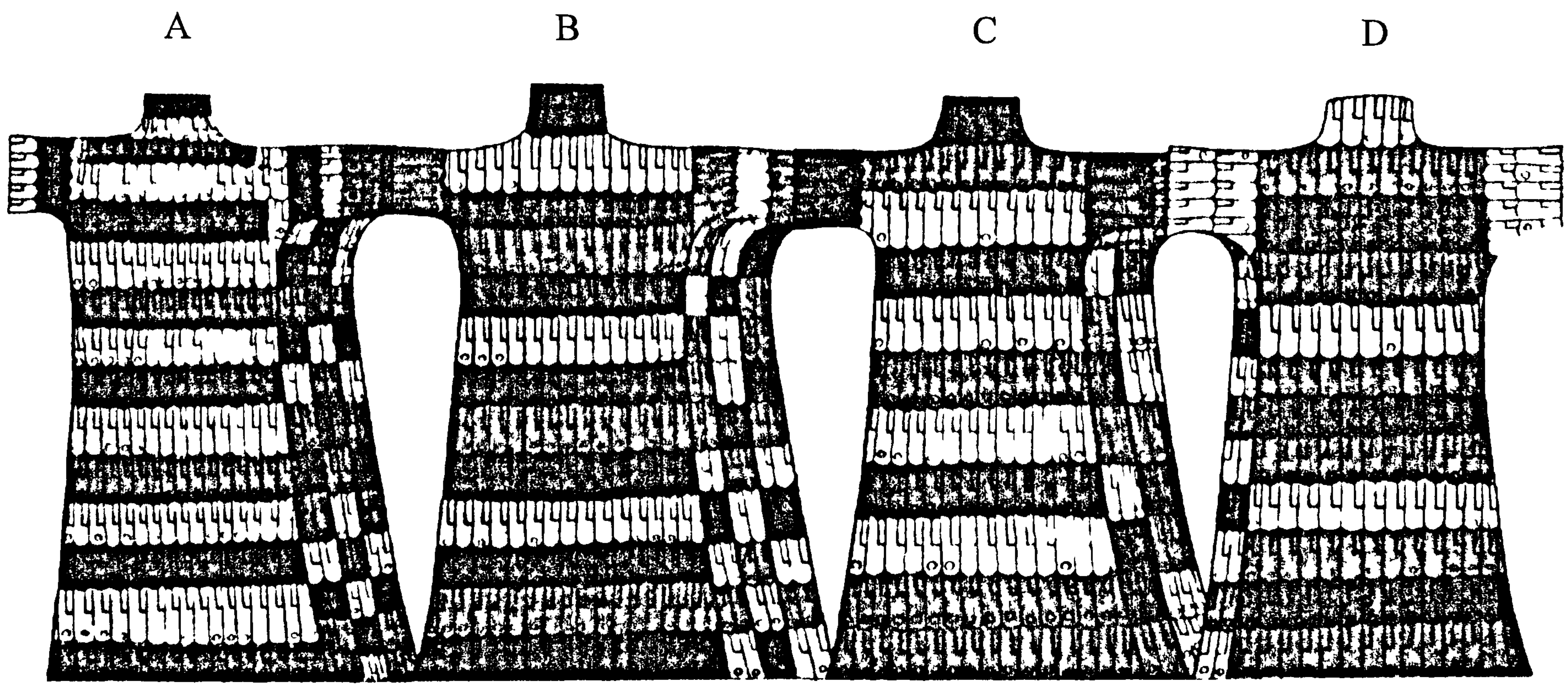
Fig. 5



One of two coats of armour depicted in the Tomb of Kenamun (Theban Tomb #93)

From: Yadin 1963: 197

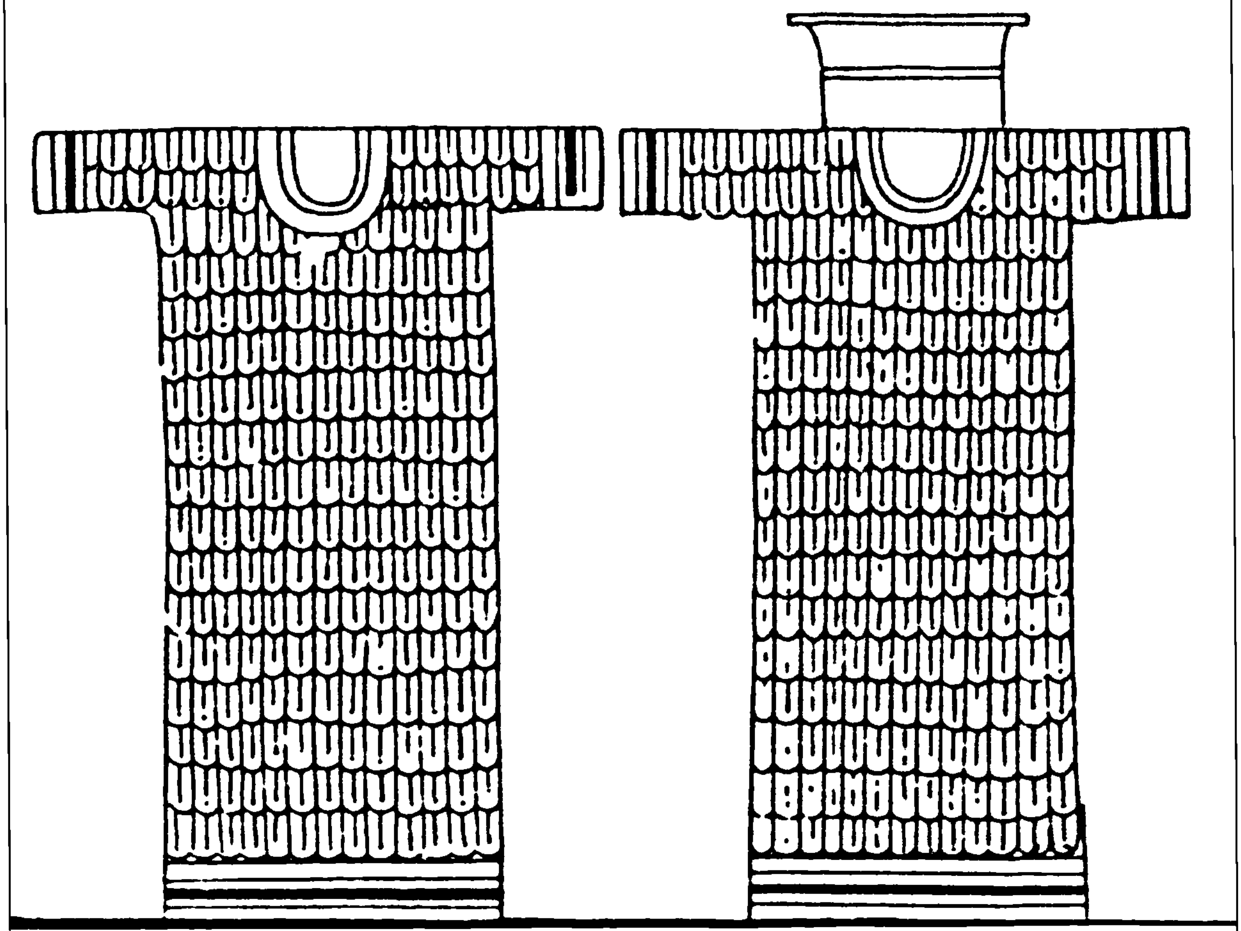
Fig. 6



Depiction of four stacks of scale armour in the Tomb of Ramses III, Valley of the Kings

Champollion 1835: Pl. 262

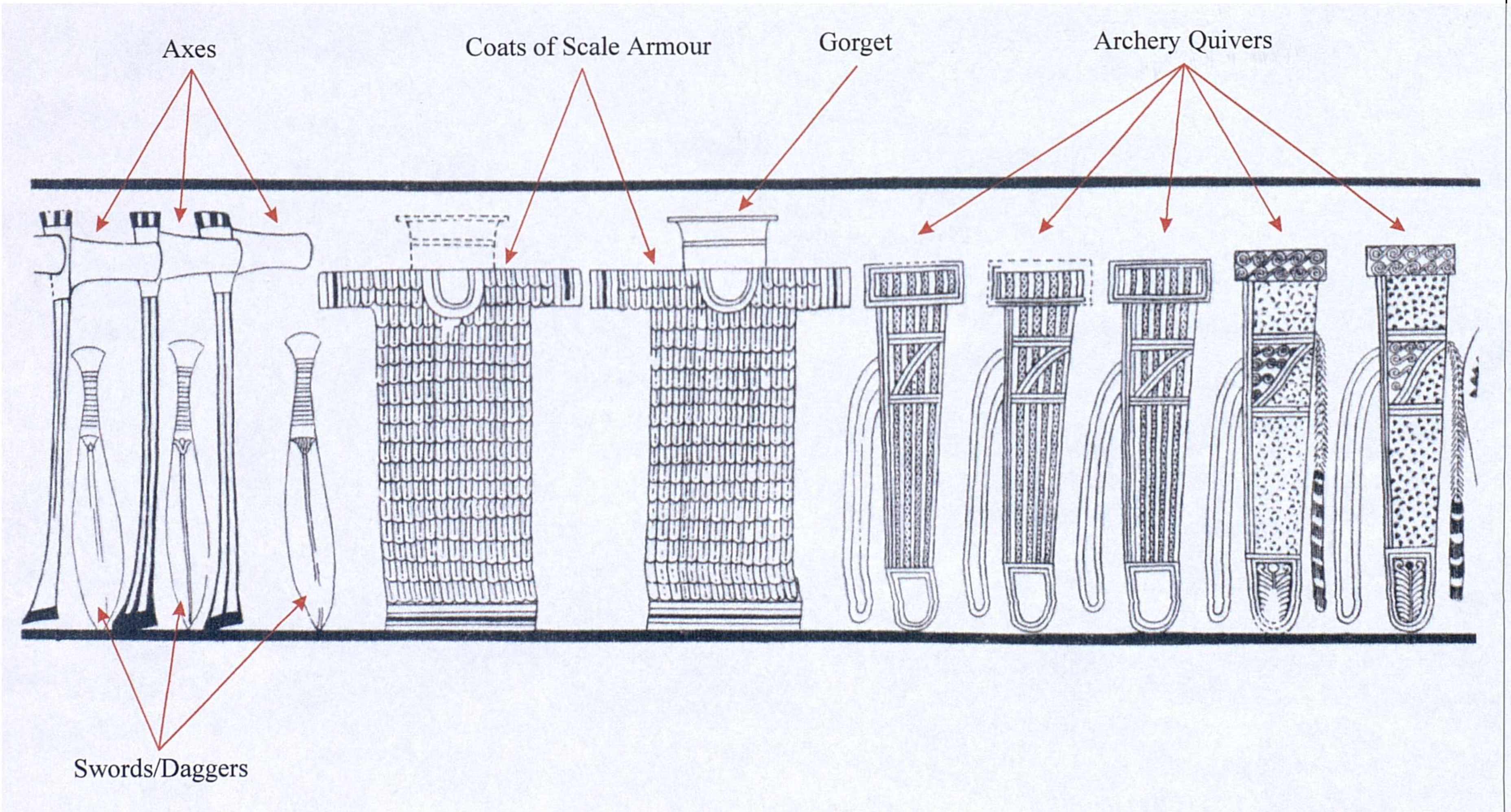
Fig. 7



Depiction of two coats of armour from the Tomb of Kenamun

Adapted from: Davies 1930

Fig. 8



Armour, swords, axes, and quivers as depicted in the Tomb of Kenamun (Theban Tomb #93)

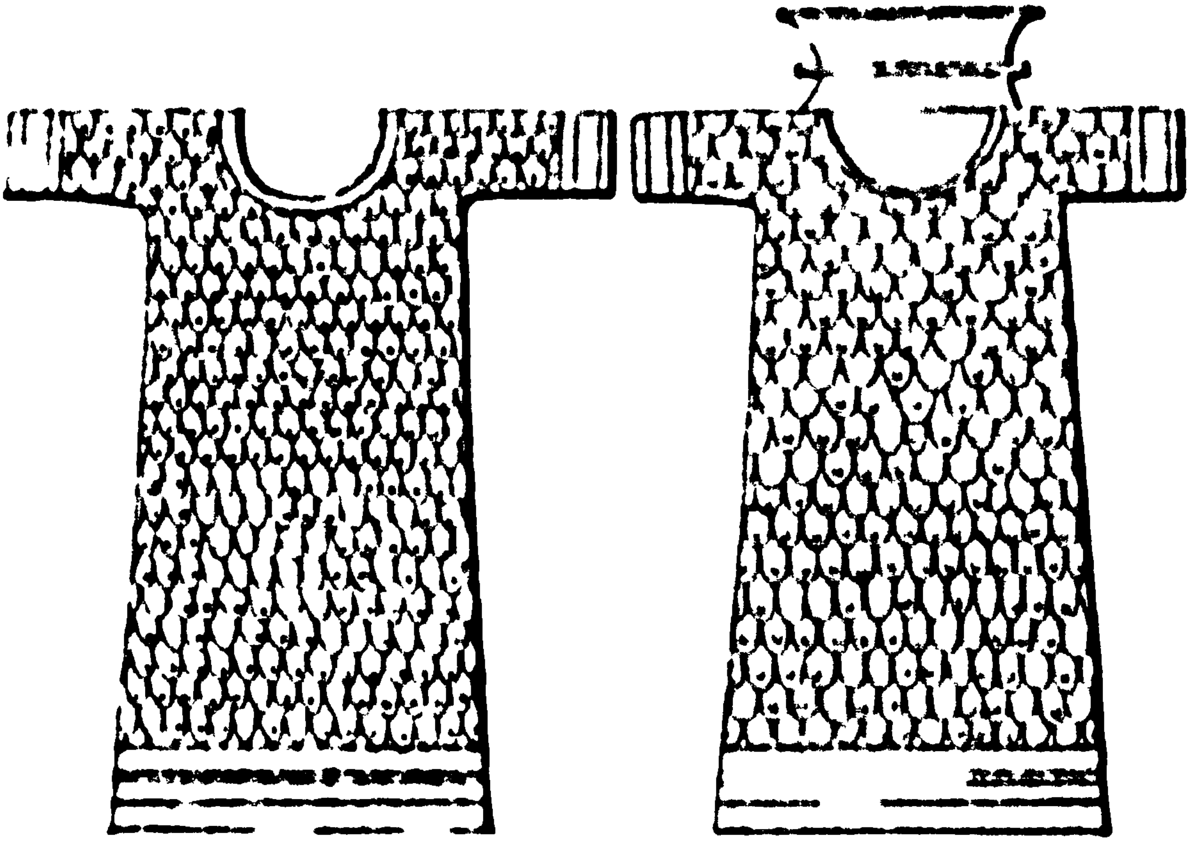
Adapted from: Davies 1930

Fig. 9

The corslet of copper alloy plate armour found at Dendra, Greece

From: Verdelis 1977: Pl.XV

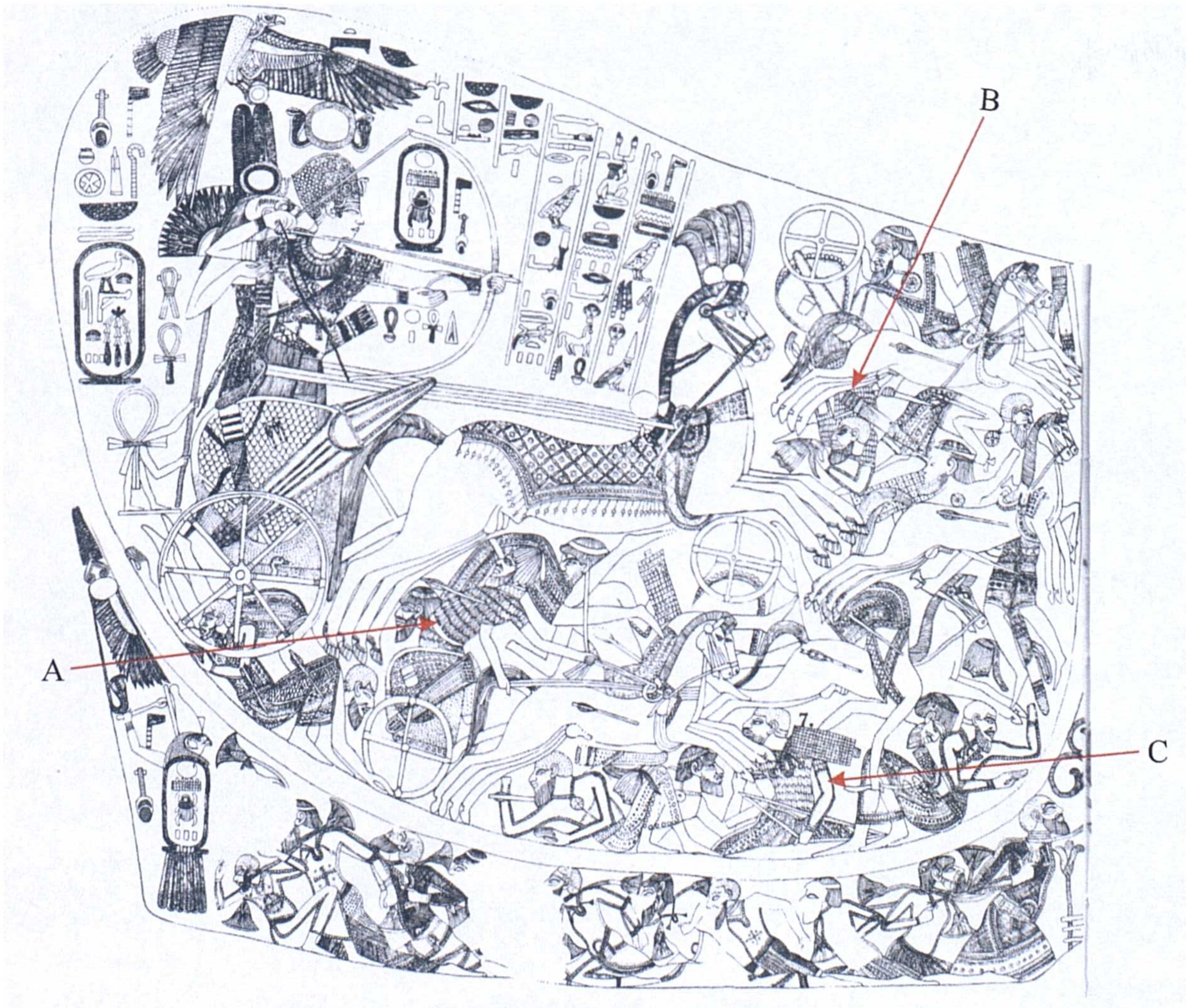
Fig. 10



Depiction of two coats of armour from the Tomb of Paimosi

Adapted from: Lepsius 1844: Pl. III: 64

Fig. 11



Outer face of the right side of Thutmosis IV's chariot body (Egyptian Museum, Cairo).

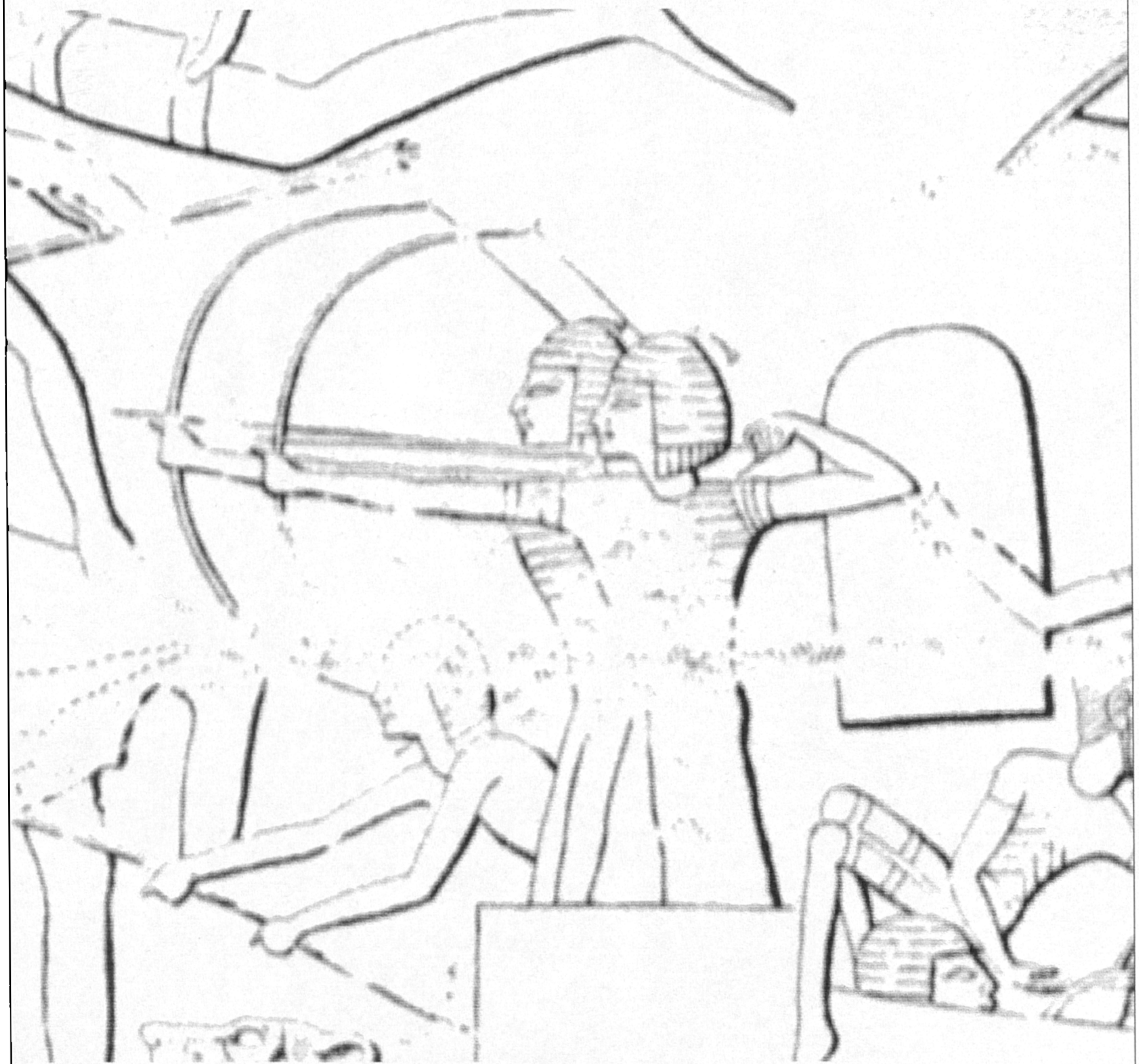
From: Yadin 1963: 192

Fig. 12

Outer face of the left side of Thutmosis IV's chariot body (Egyptian Museum, Cairo).

From: Yadin 1963: 193

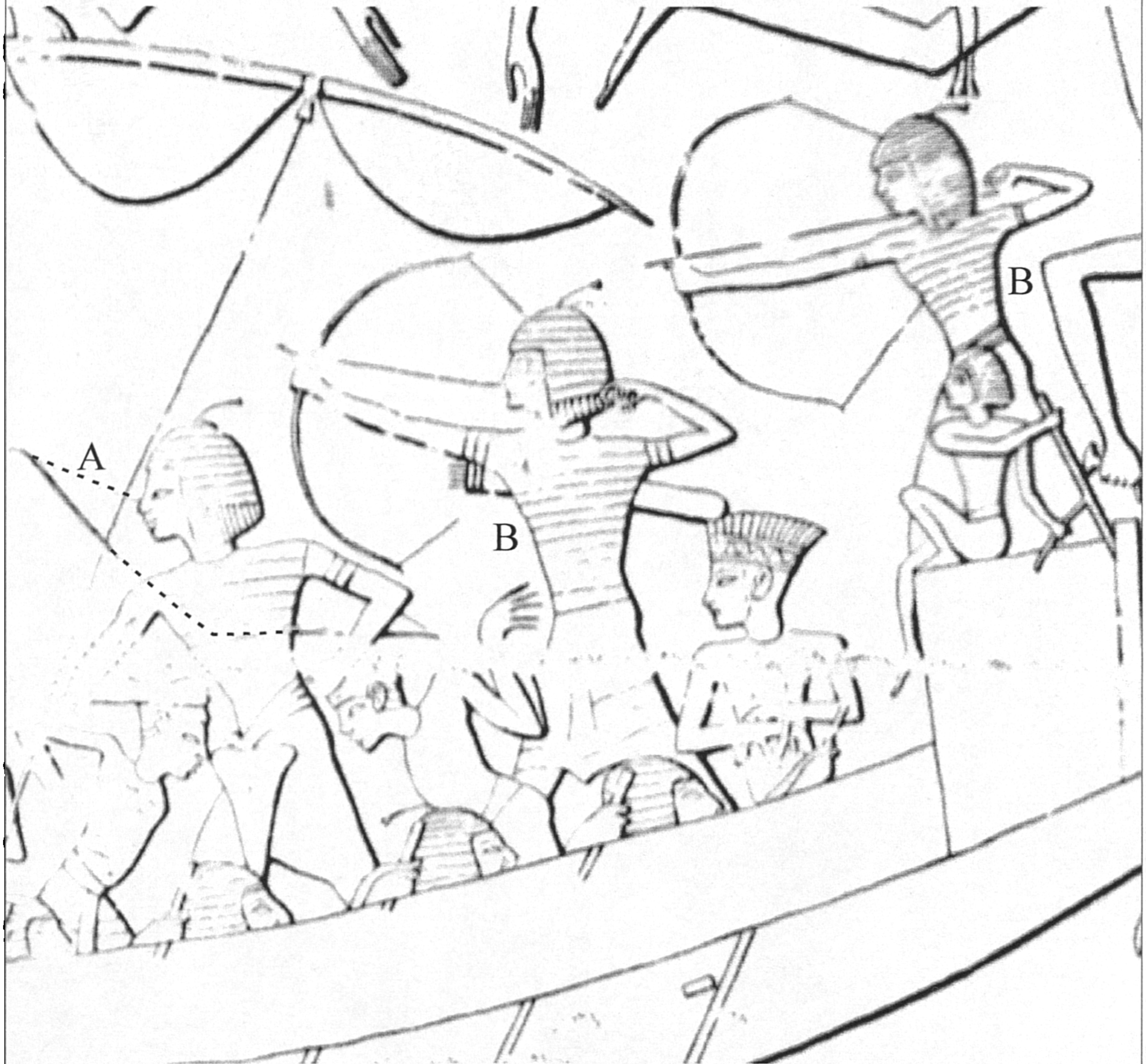
Fig. 13



Egyptian Soldiers in the Naval Battle Depicted at Medinet Habu, Thebes

Adapted from: Breasted 1930: Pl. 39

Fig. 14



A - Egyptian soldier with angular composite bow over his shoulder
B - Egyptian soldiers wearing scale armour

Egyptian Soldiers in the Naval Battle Depicted at Medinet Habu, Thebes

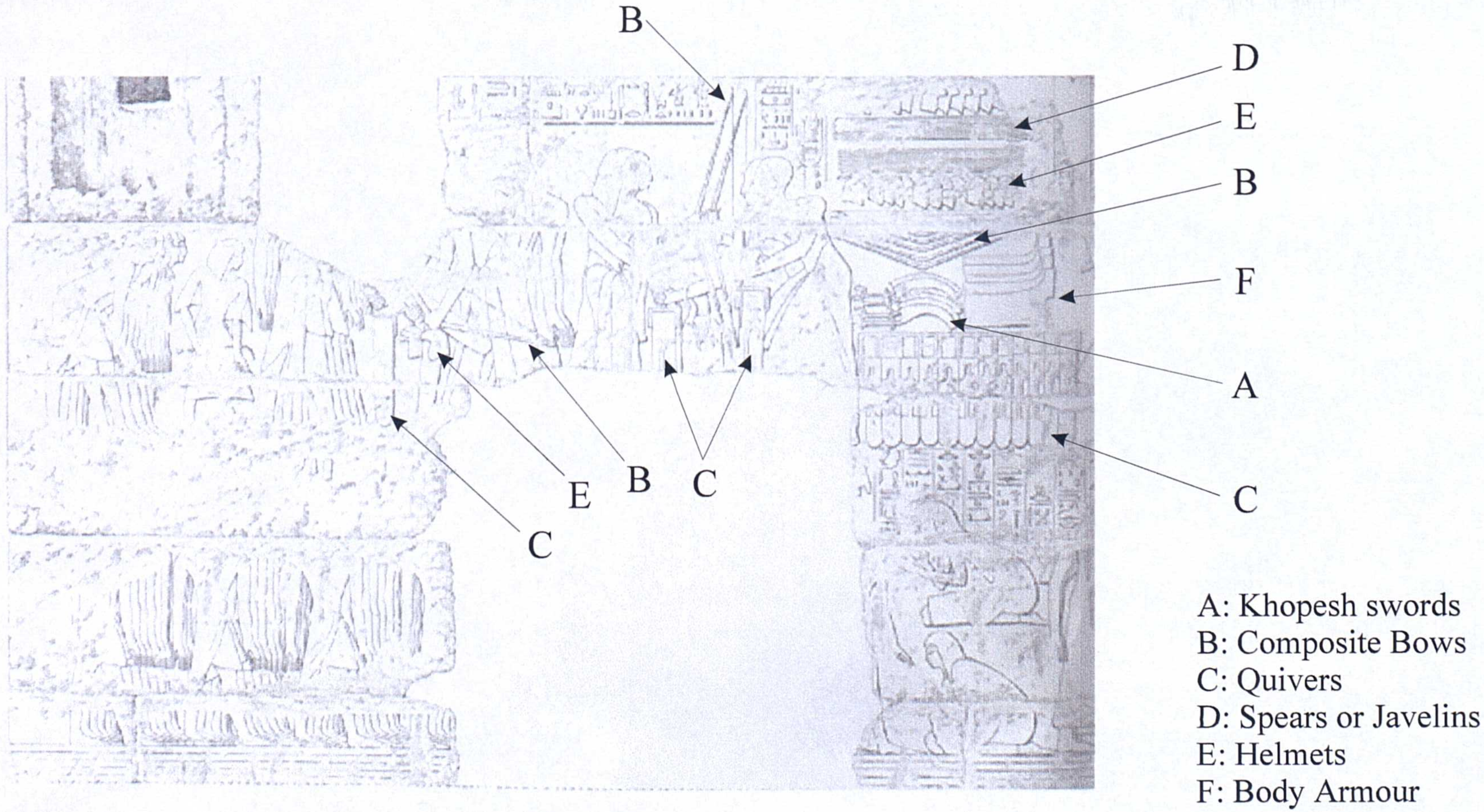
Adapted from: Breasted 1930: Pl. 39

Fig. 15

A - Scale Armour
B - Scourge
C - Shield

Egyptian Soldier in the Naval Battle Depicted at Medinet Habu, Thebes

Adapted from: Breasted 1930: Pl. 39

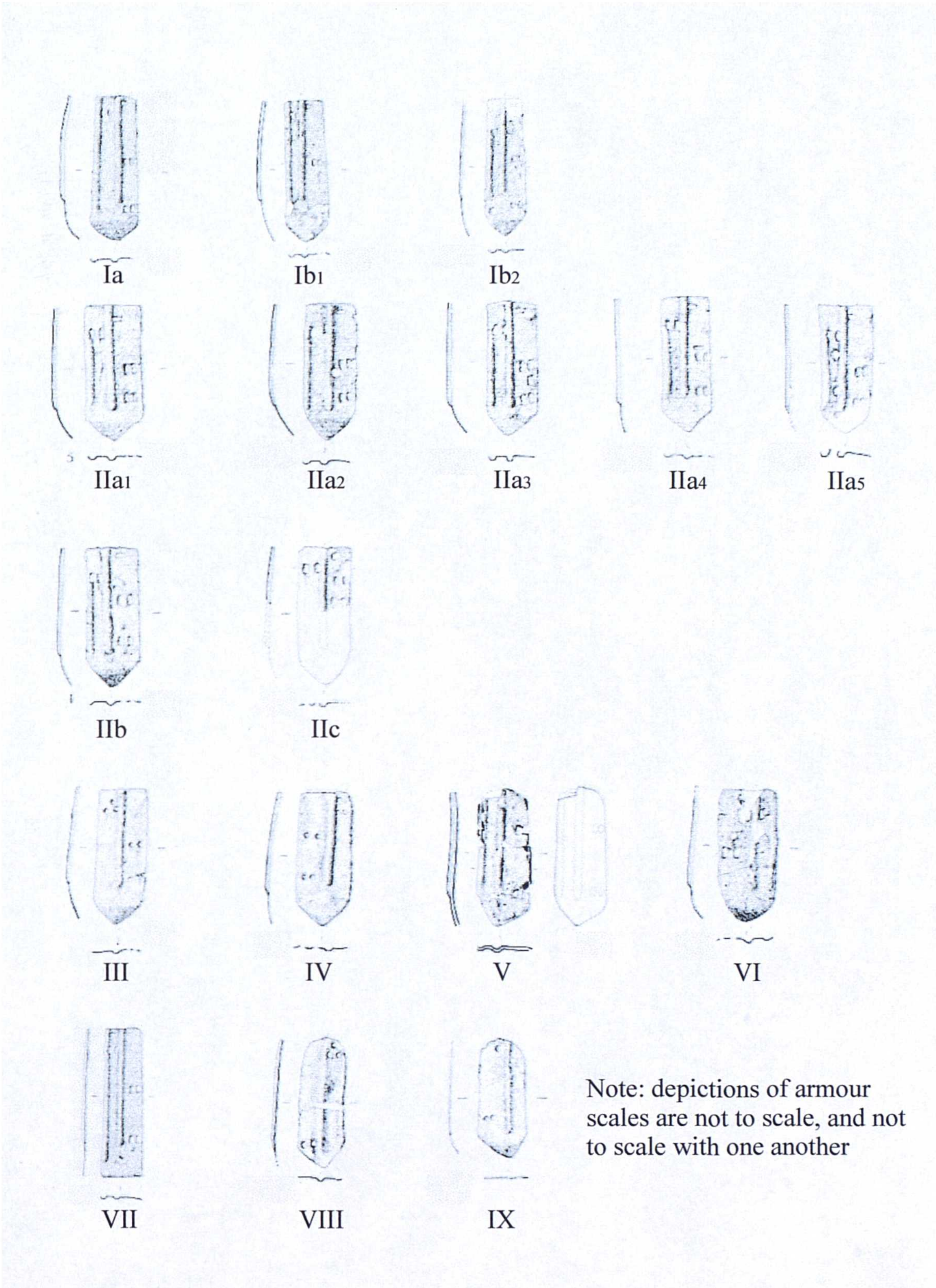


Ramses III Equipping his Troops Prior to Battle with the Sea Peoples.

Adapted from: Breasted 1930: Pl. 29

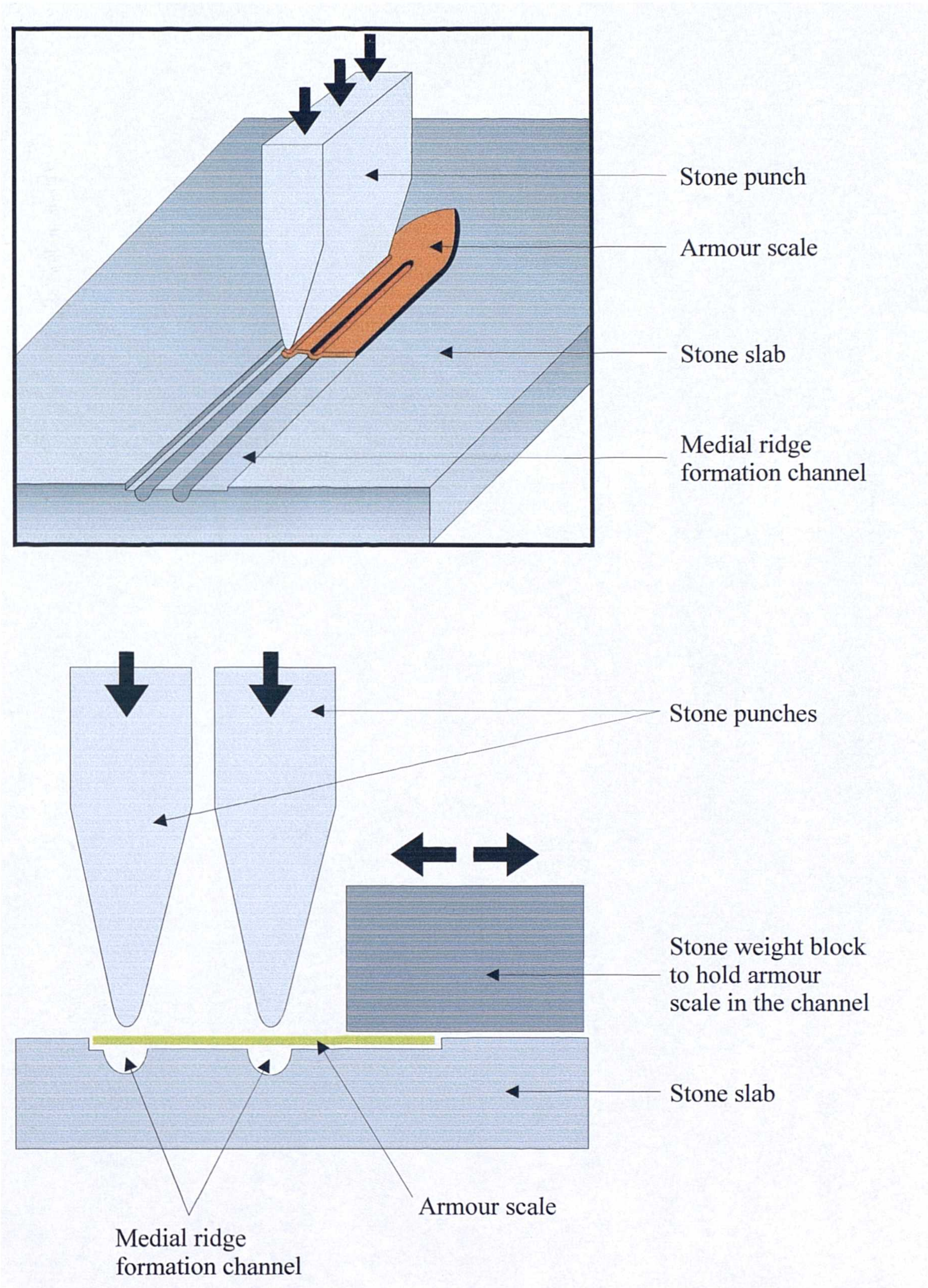
Fig. 16

Fig. 17



Armour scale types and sub-types from Kamid el-Loz

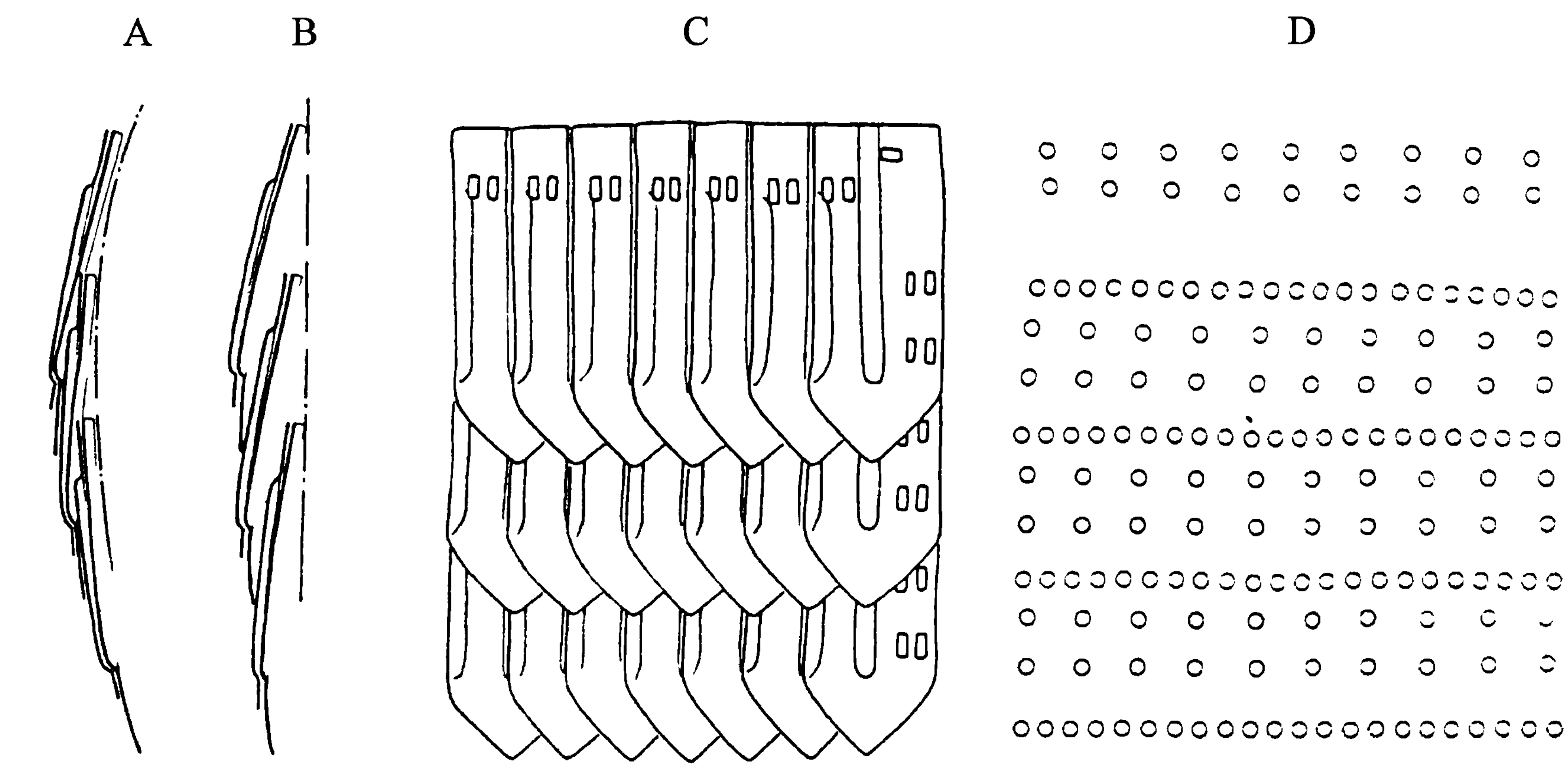
Adapted from: Ventzke 1986: Tables 21 and 22



Punches or press for forming the medial ridges in bronze armour scales

Adapted from: Ventzke 1986: 167, fig. 27

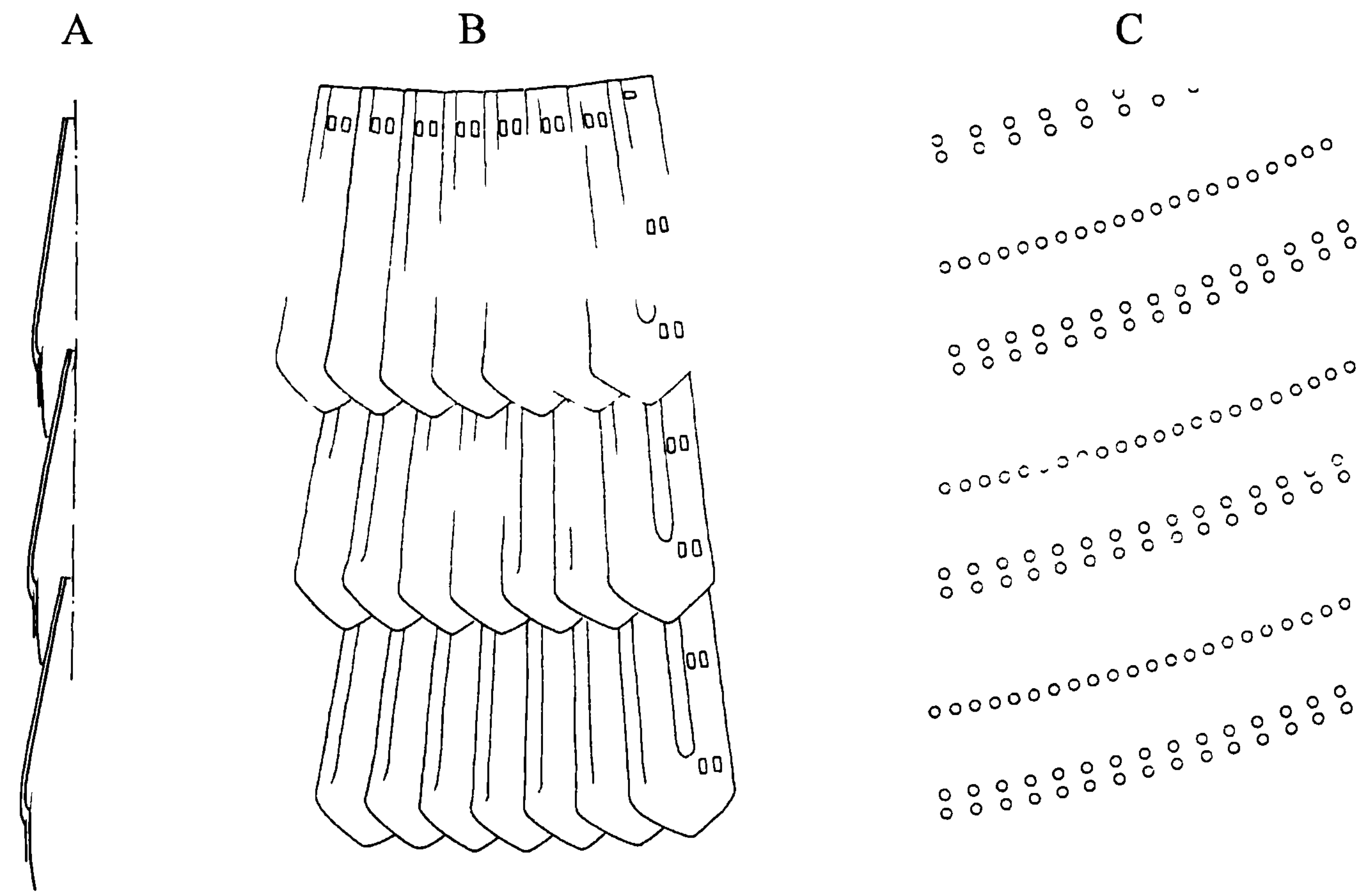
Fig. 19



Method of overlap for scales with parallel edges

From: Ventzke 1986:171, fig. 31

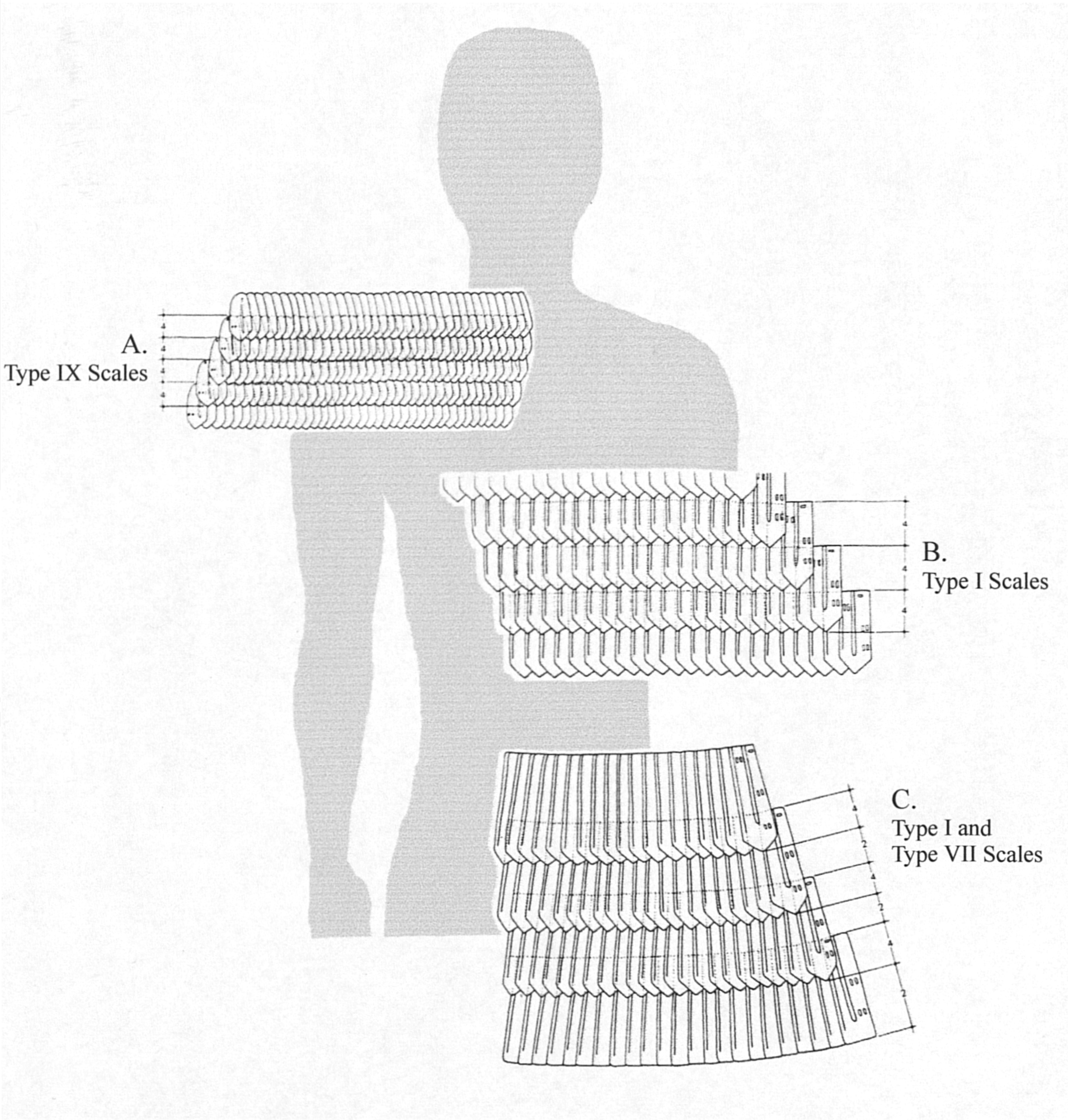
Fig. 20



Method of overlap for scales with tapered edges

From: Ventzke 1986:170, fig. 30

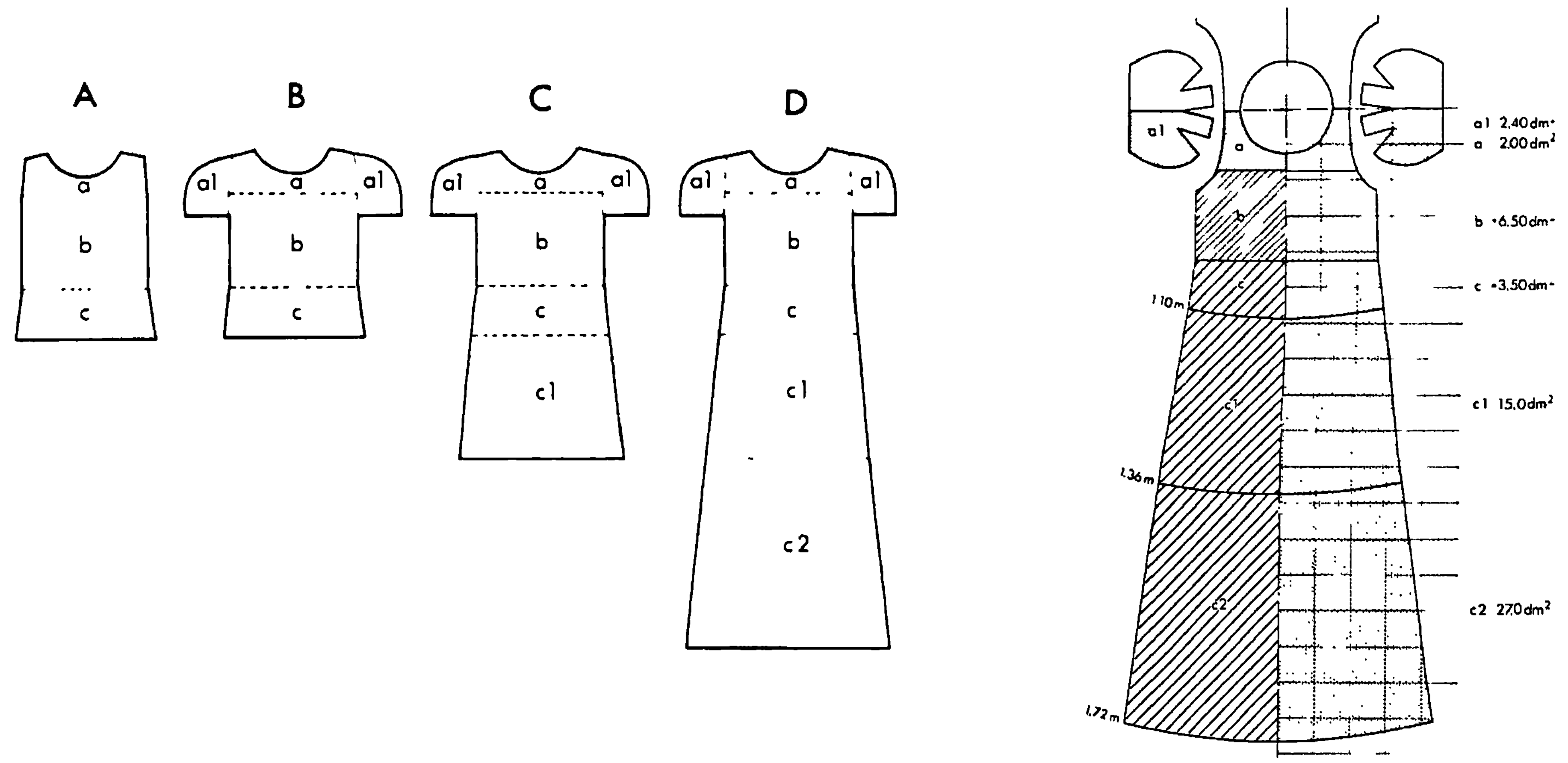
Fig. 21



Overlap and possible positions for Kamid el-Loz scale types

From: Ventzke 1986:172, fig. 32

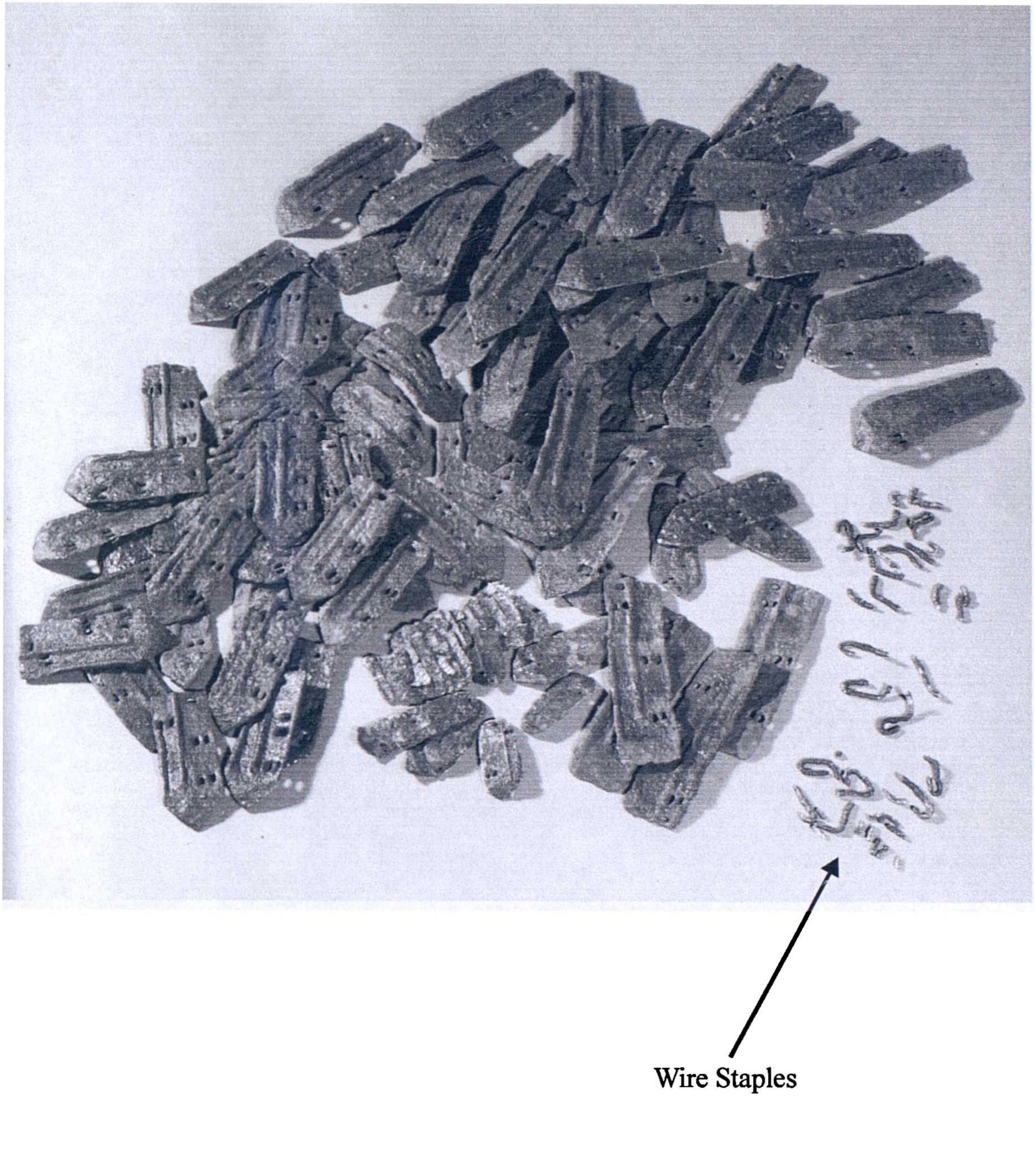
Fig. 22



The four styles of armour hypothesised by Ventzke (1986)

From: Ventzke 1986:174-175, figs. 34,35

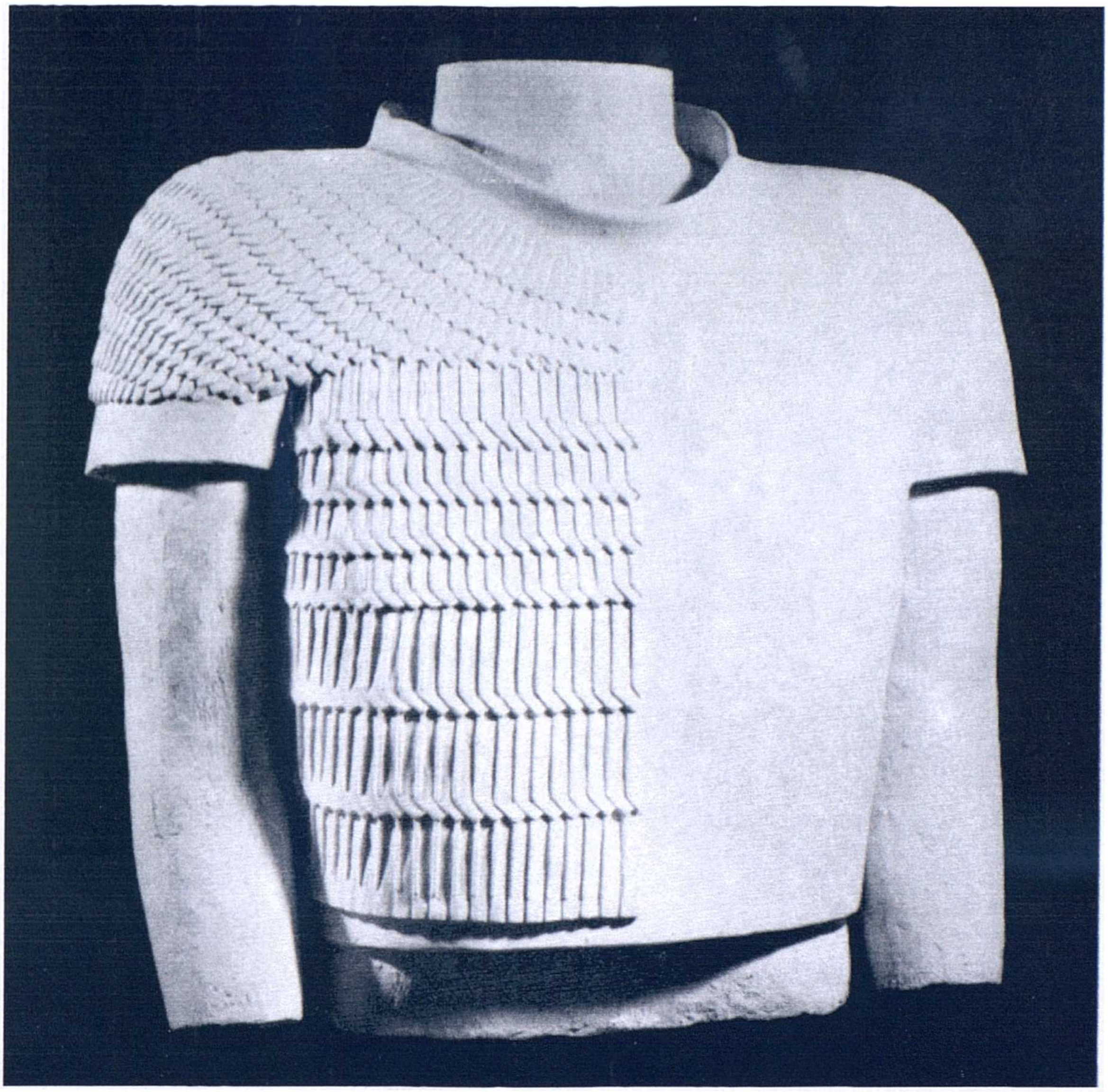
Fig. 23



A selection of armour scales and wire staples from Kamid el-Loz

From: Hachmann 1983: 117

Fig. 24



One possible appearance of the armour from Kamid el-Loz

From: Hachmann 1983: 149, Fig. 54

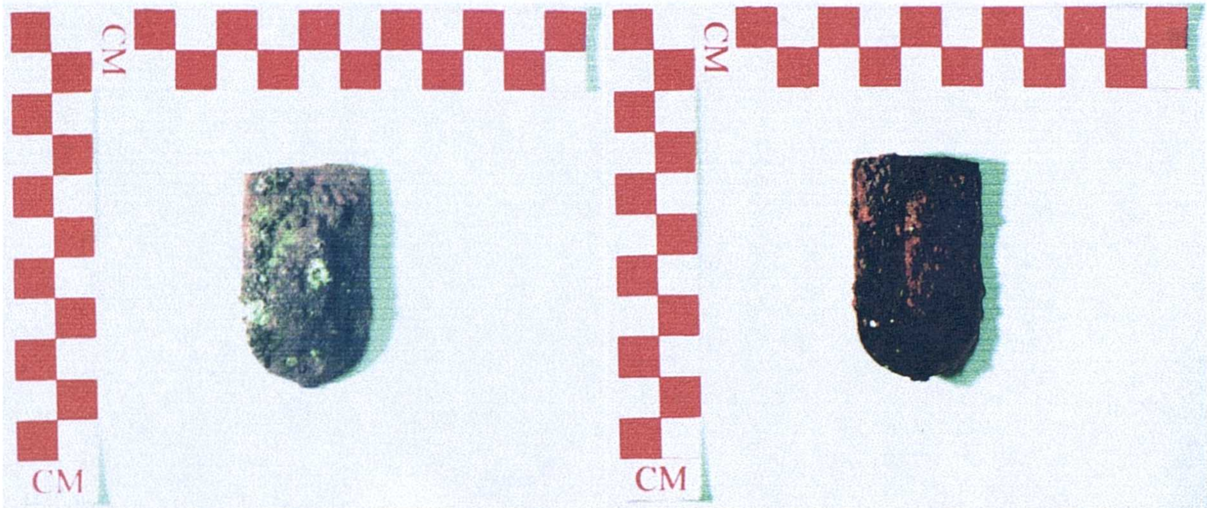
Fig. 25

Possible appearance of Late Bronze Age scale armour

From: Healy and McBride 1992: Plate I

Fig. 26

A: Nuzi 1930.76.2



Front

Back

B: Nuzi 1930.76.10

Two armour scales from the 1930 excavations at Nuzi

Fig. 27

A: Nuzi 1930.76.36

Front

Back

B: Five armour scales from Nuzi

Nuzi 1930.76.3

Nuzi 1930.76.4

Nuzi 1930.76.5

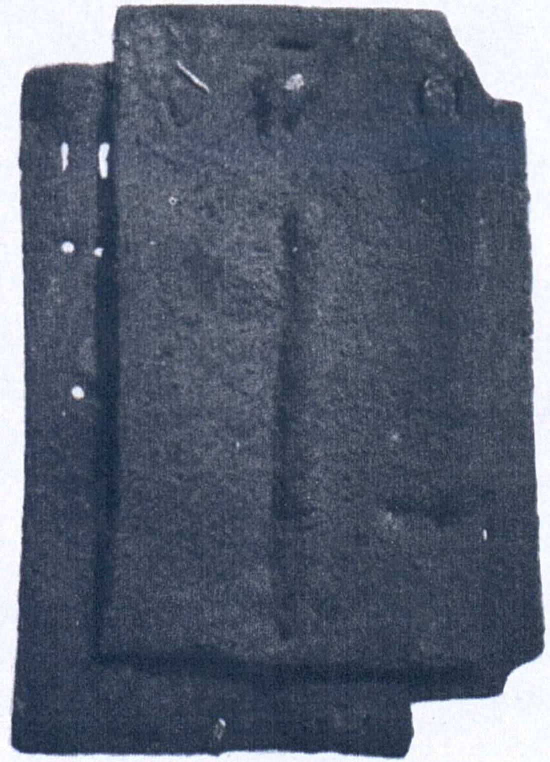
Nuzi 1930.76.7

Nuzi 1930.76.9

A selection of armour scales from the 1930 excavations at Nuzi

Fig. 28

A: Nuzi Type 6 armour scale (depicted at 1:2)



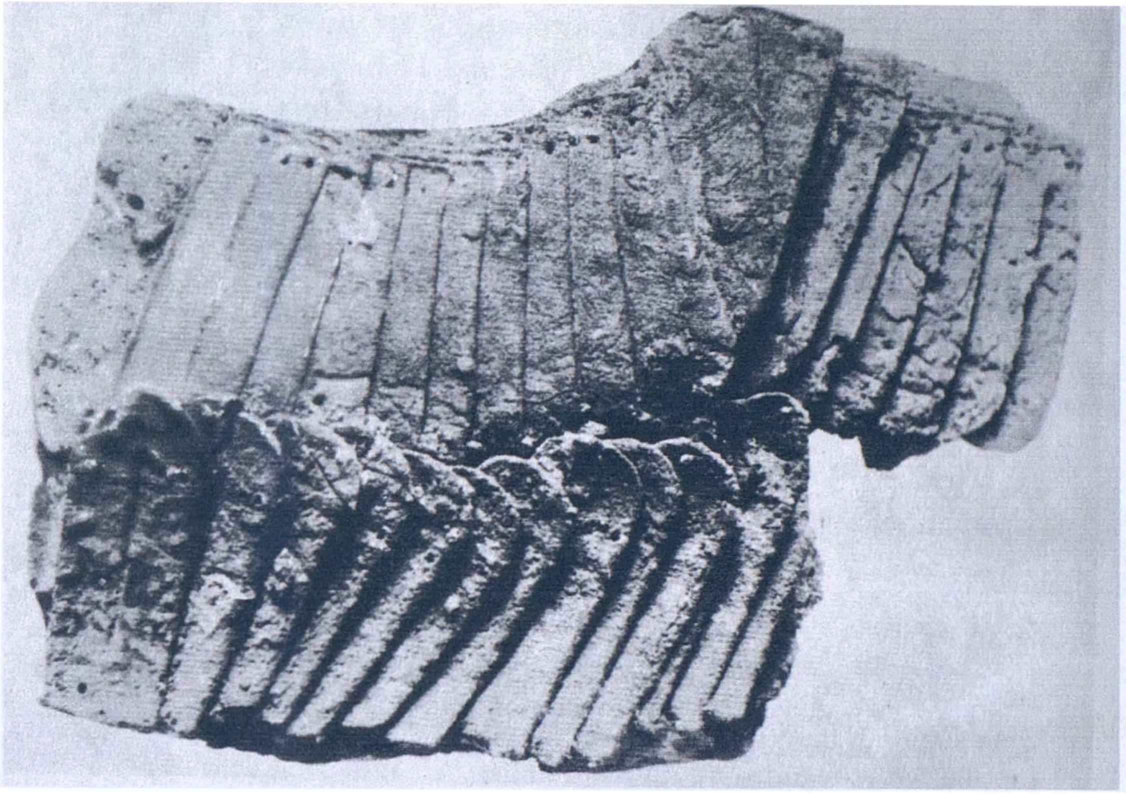
B: Nuzi Type 7 armour scale 1930.76.8 (depicted at 1:1.3)

C: Nuzi Type 7 armour scale 1930.76.8 (depicted at 1:1.3)

Two unique scale types from Nuzi

A from: Starr 1937: Pl. 126 O
B from: Starr 1937: Pl. 126 L
C: © T. Hulit 2000

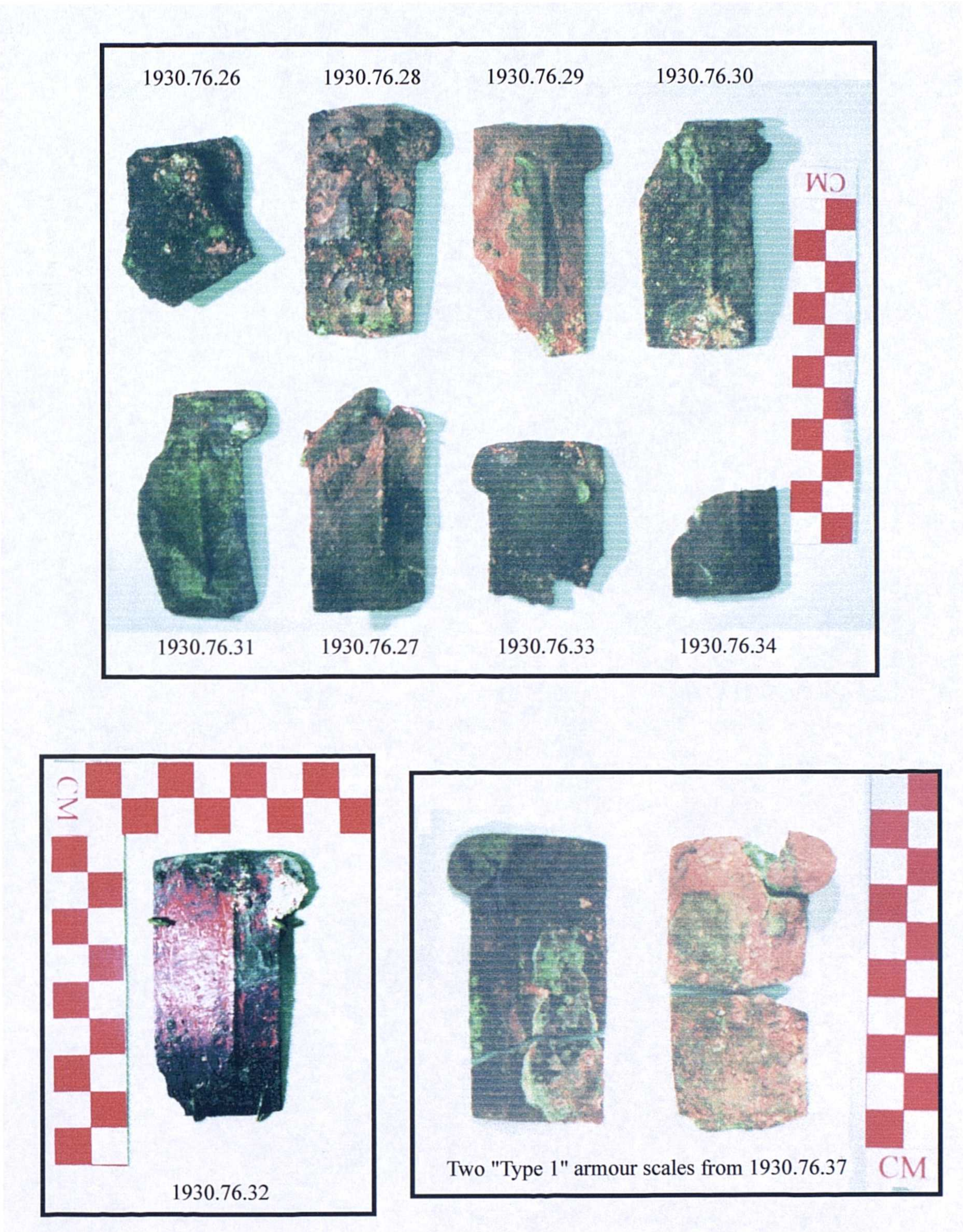
Fig. 29



Section of 36 fused armour scales from Nuzi

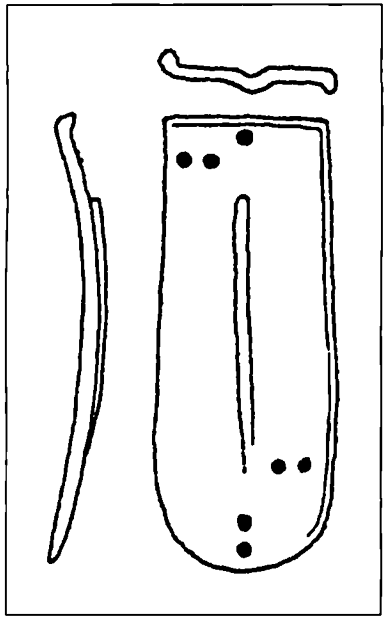
From: Yadin 1963: 196

Fig. 30

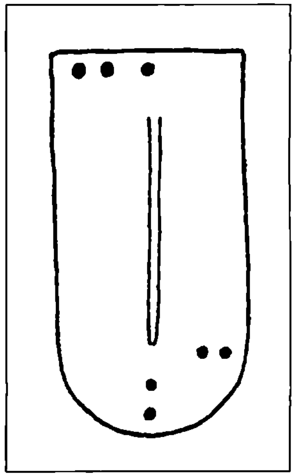


A selection of "Type 1" unperforated armour scales from the 1930 excavations at Nuzi

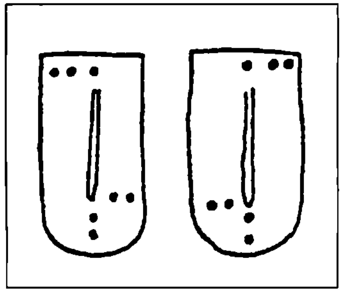
Fig. 31



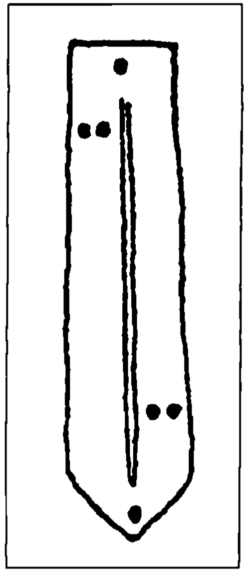
Type 2 (Kendall 1974: 272)



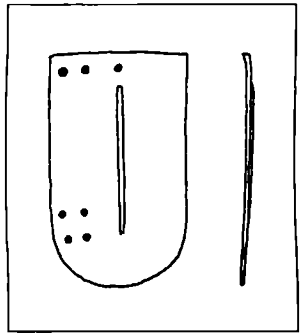
Type 3 (Kendall 1974: 274)



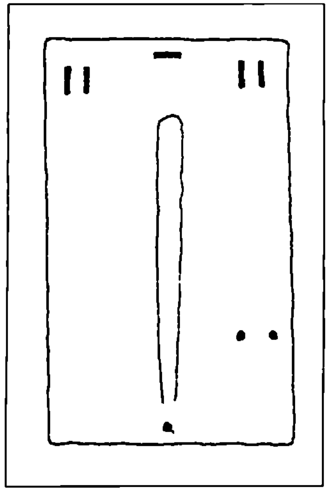
Type 5 (Kendall 1974: 276)



Type 6 (Kendall 1974: 276)



Type 4 (Kendall 1974: 274)

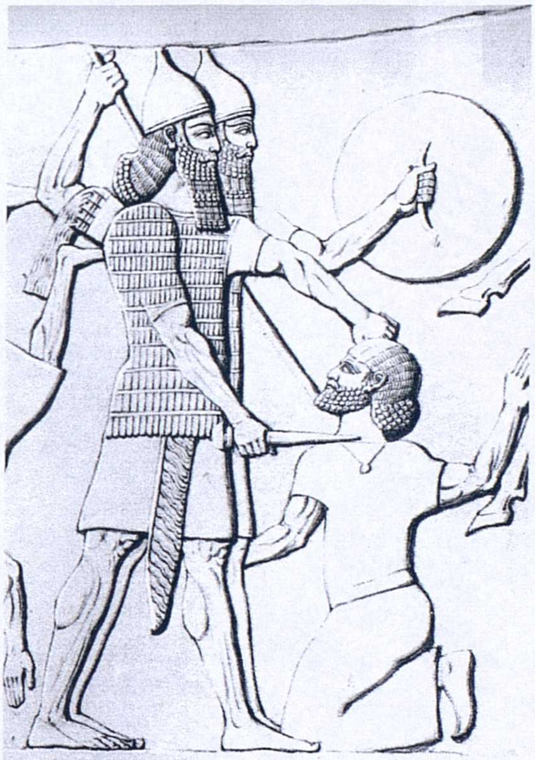


Type 7 (Kendall 1974: 286)

The armour "Scale Types" suggested by Kendall 1974

Fig. 32

A

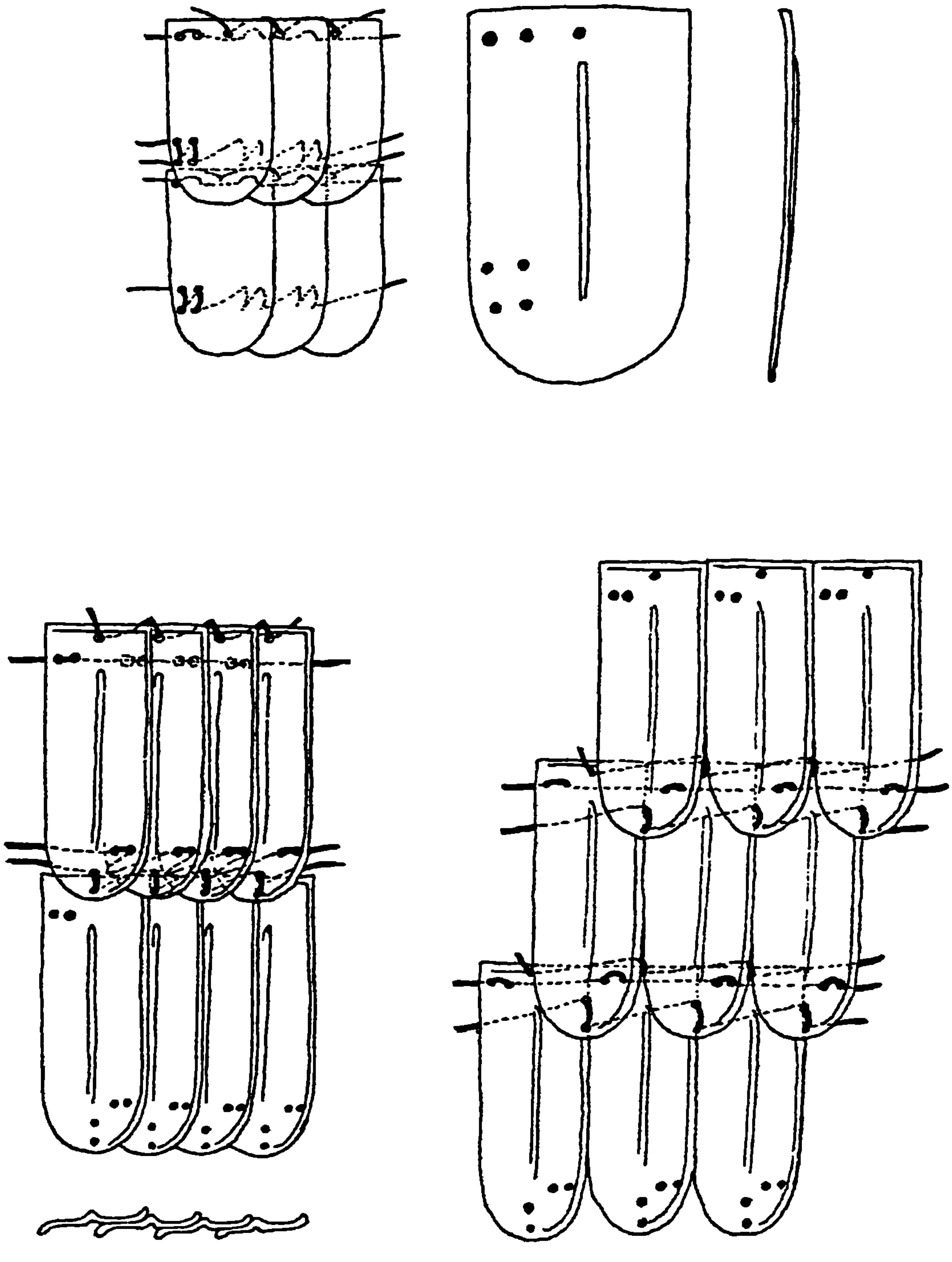


B

Possible appearances of armour made from Nuzi Type I scales

From: Barnett and Faulkner 1962: Pls. LII and LVIII

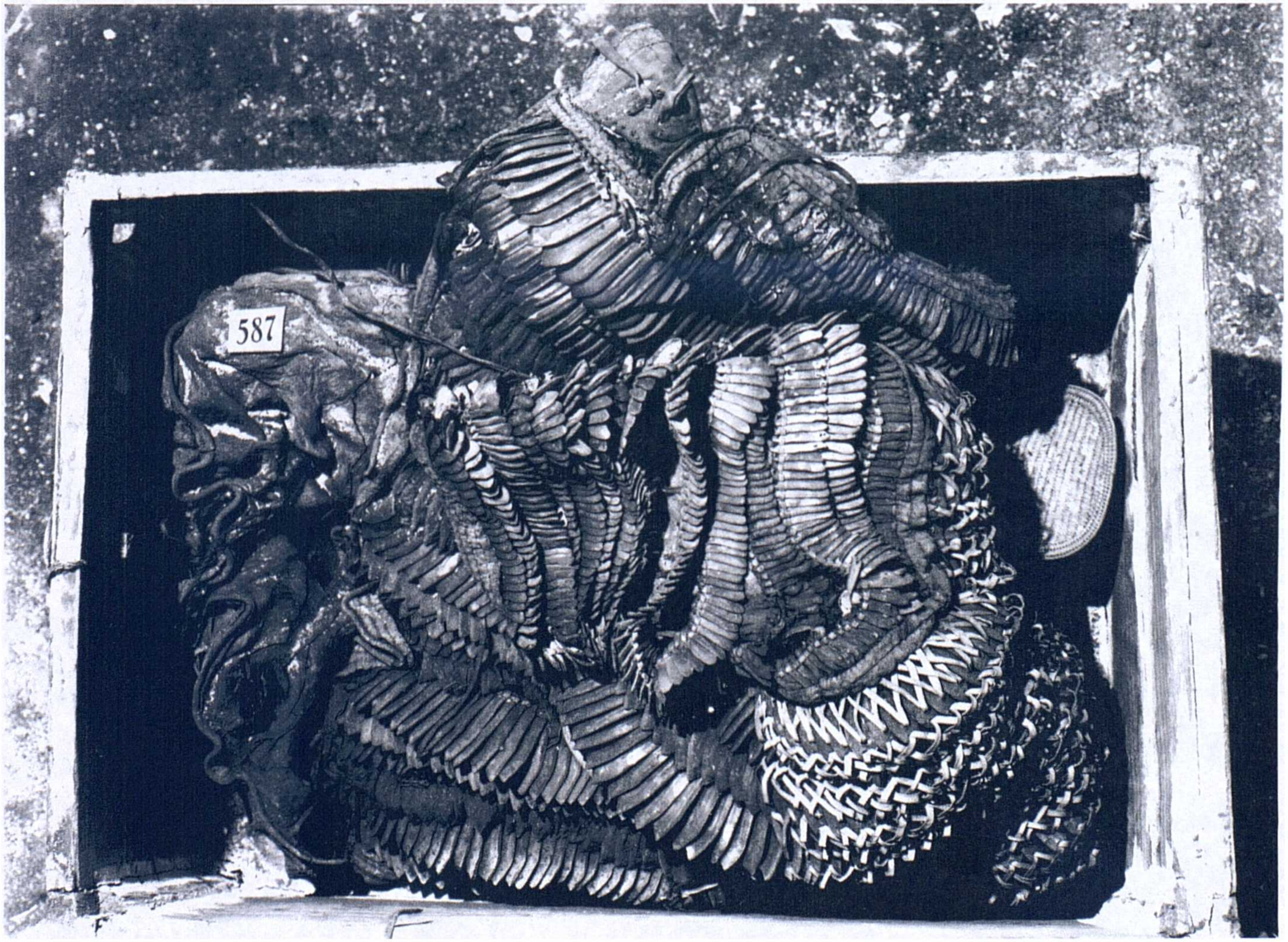
Fig. 33



Three lacing patterns suggested by Kendall (1974) for the armour scales from Nuzi

From: Kendall 1974: 273,274

Fig. 34



Original photograph of Object 587a taken by Harry Burton shortly after the armour was removed from TutAnkhamun's tomb

Image courtesy of the Griffith Institute, Oxford

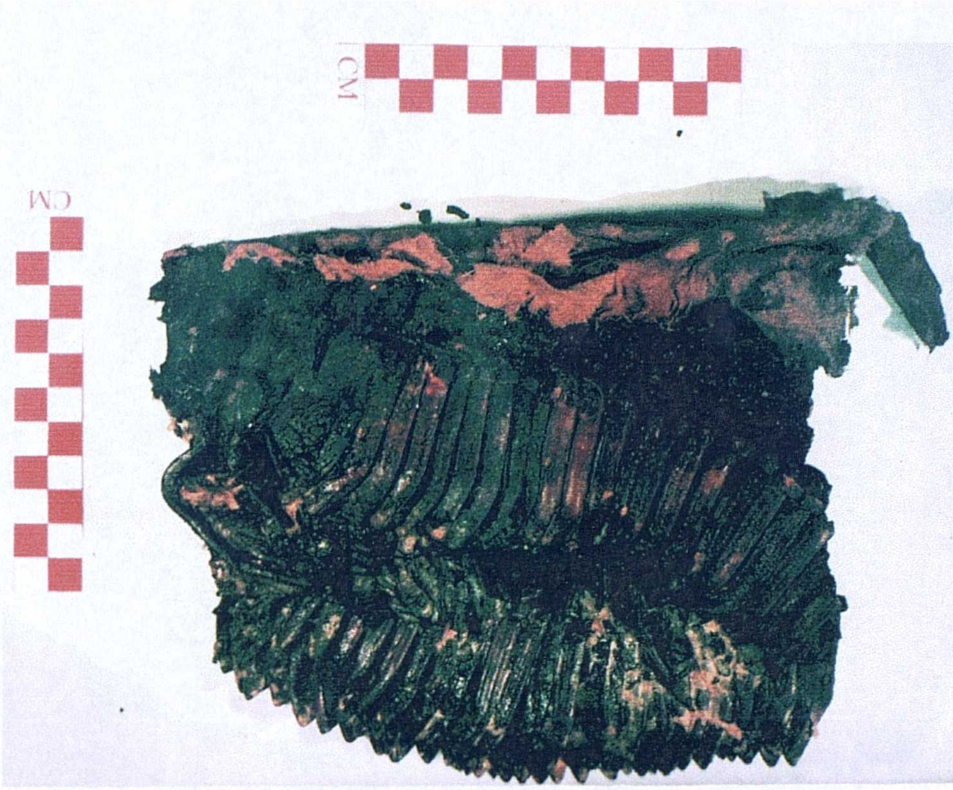
Fig. 35

A

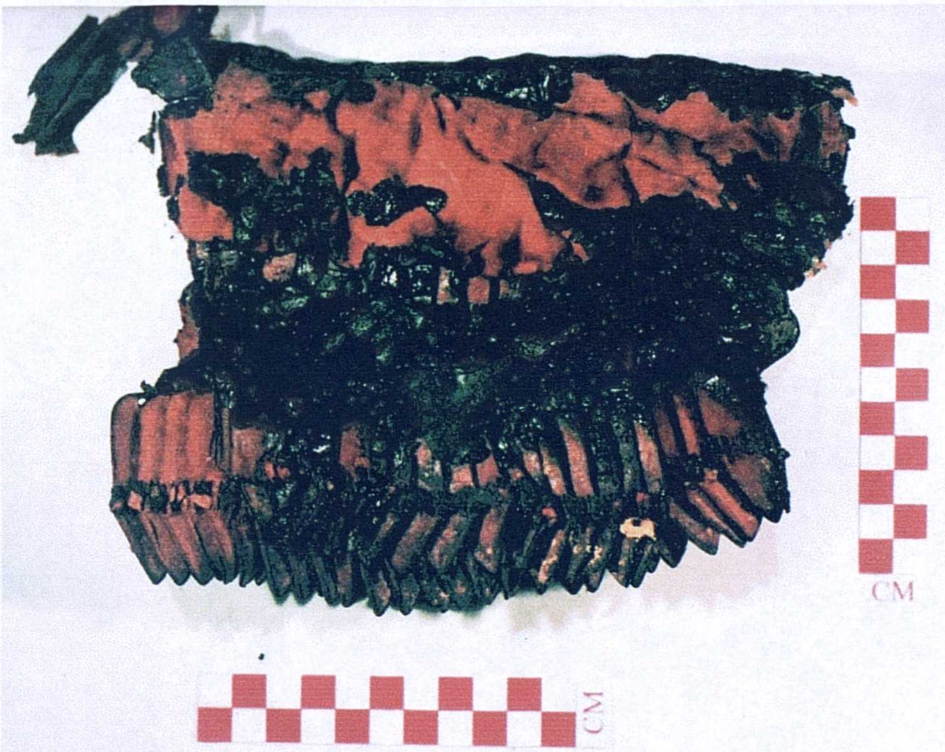
B

Box containing pieces of Tut'Ankhamun's armour, and a tray of detached scales

Fig. 36



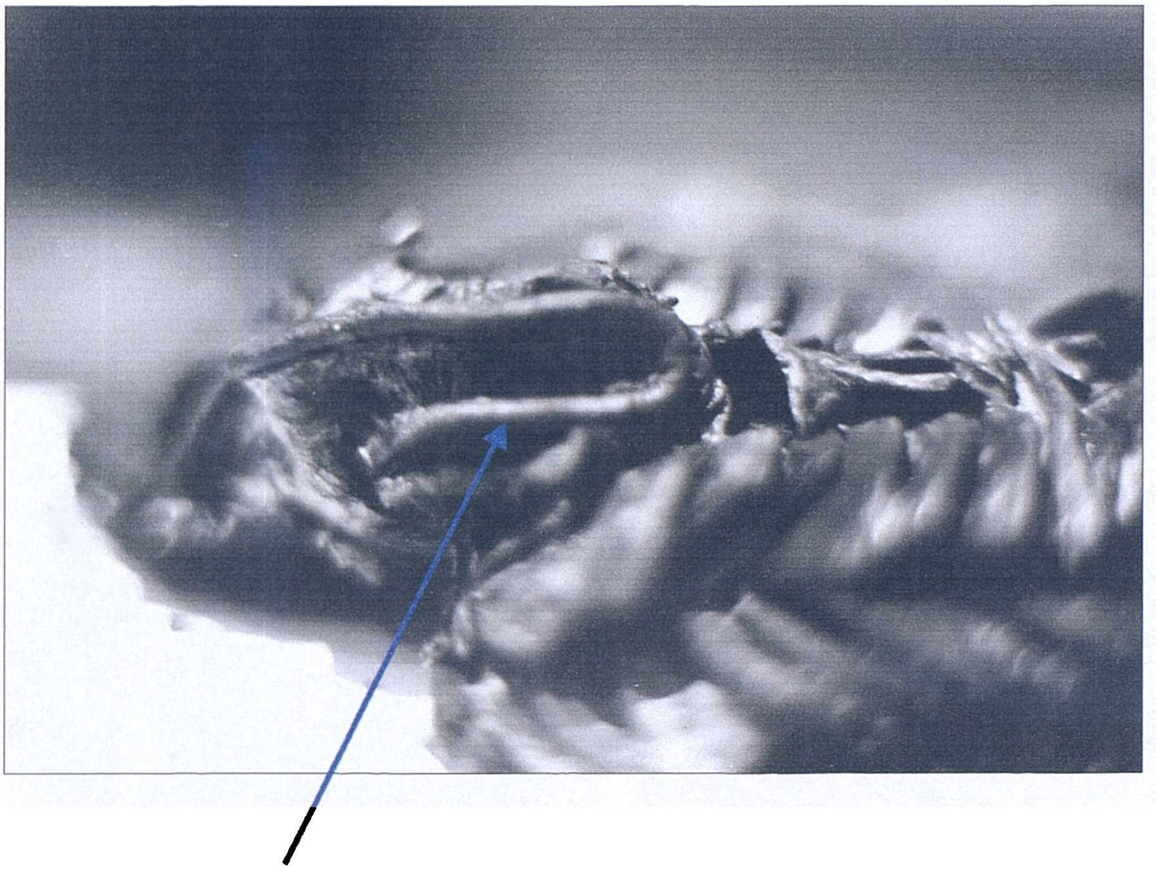
front view



back view

Two views of the largest surviving section of Tut'Ankhamun's armour

Fig. 37



Section of Tut'Ankhamun's armour in which one armour scale has become bent over time

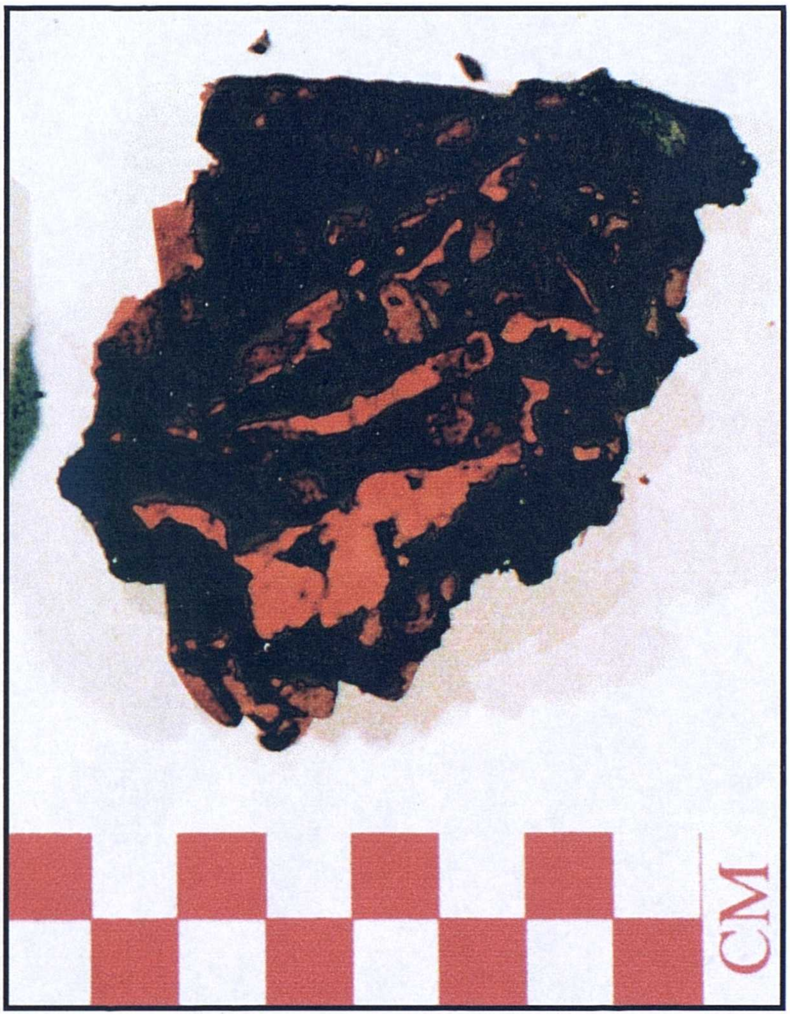
Fig. 38

A: Section of cross-laced armour scales

B: Detail of a section of cross-laced armour scales

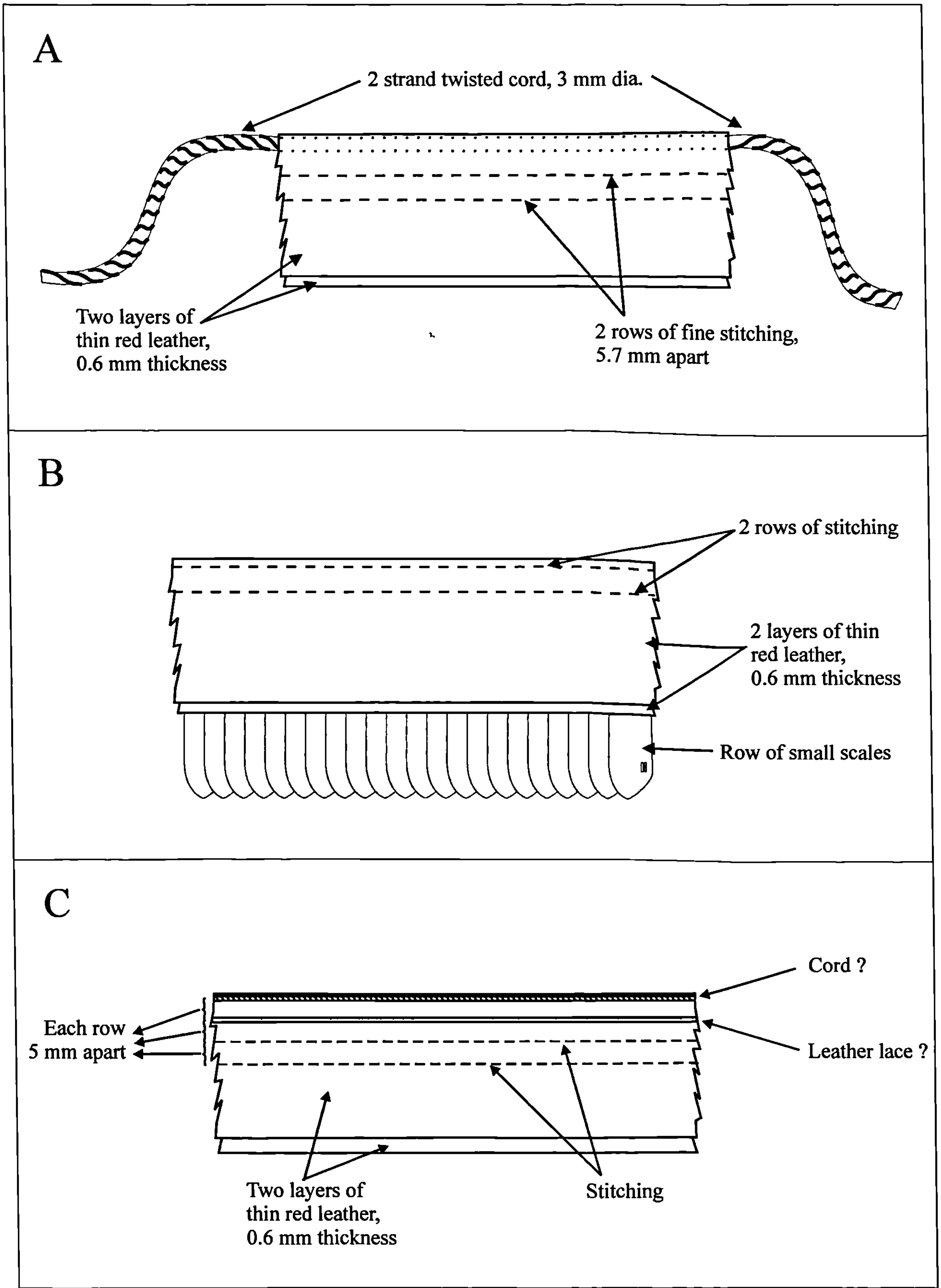
Section of Tut'Ankhamun's armour showing the cross-lacing

Fig. 39



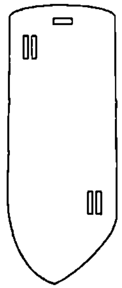
Section of Tut'Ankhamun's armour showing the thin leather backing

Fig. 40

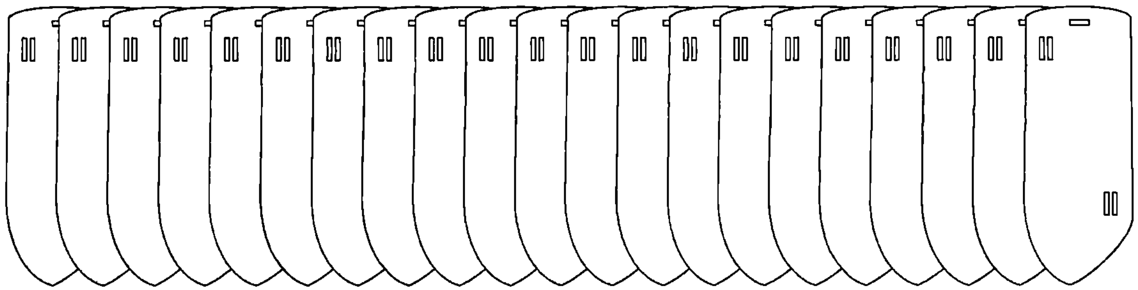


Three forms of stitching on the edges of the armour found in the tomb of TutAnkhamun.

Fig. 41



Typical Asymmetrical Armour Scale



"Symmetrical" Lower Edge Resulting
from the Overlap of Asymmetrical Scales.

Asymmetrical scale and the "symmetrical" lower edge pattern resulting from the overlap of asymmetrical armour scales in the armour from the tomb of Tut'Ankhamun

Fig. 42

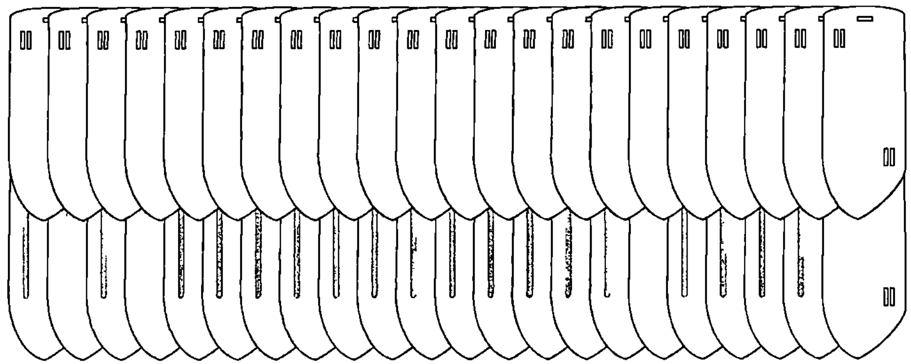
A - The Front of a Selection of Armour Scales from Tut'Ankhamun's armour

B - The Back of a Selection of Armour Scales from Tut'Ankhamun's armour

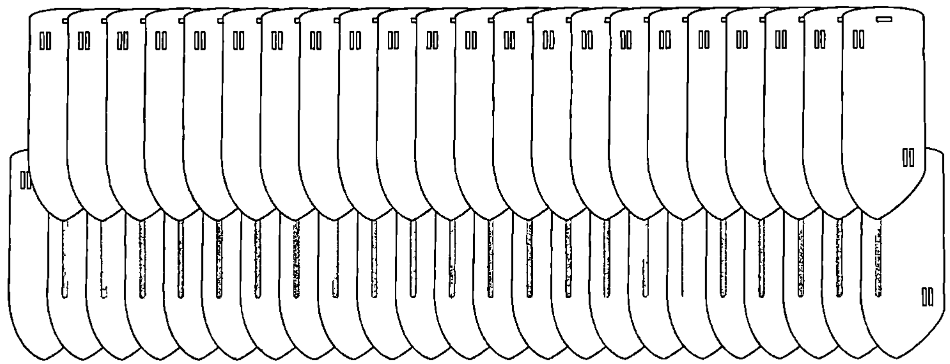
Appearance of the front and back surfaces of a selection of scales from Tut'Ankhamun's rawhide armour

Fig. 43

A

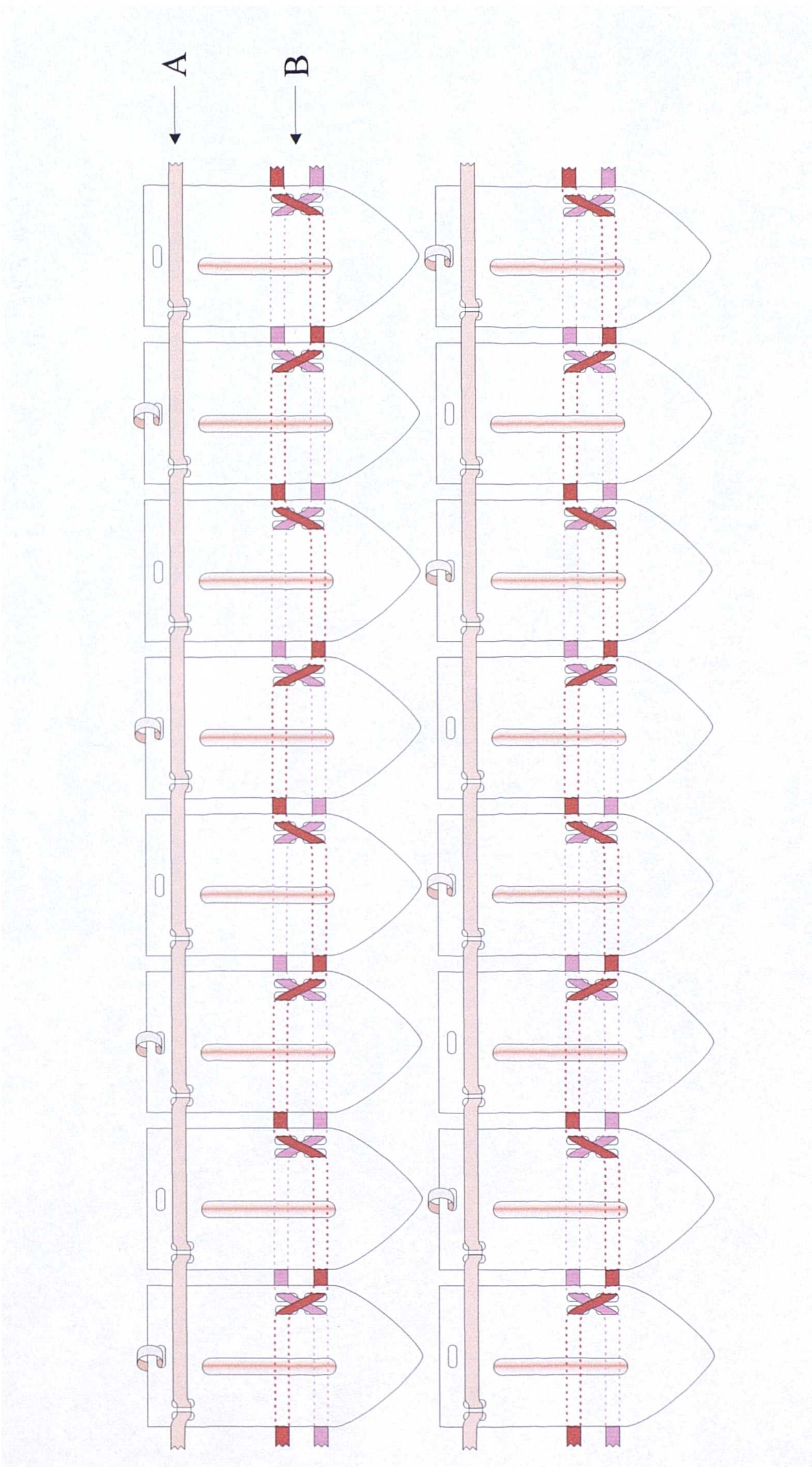


B



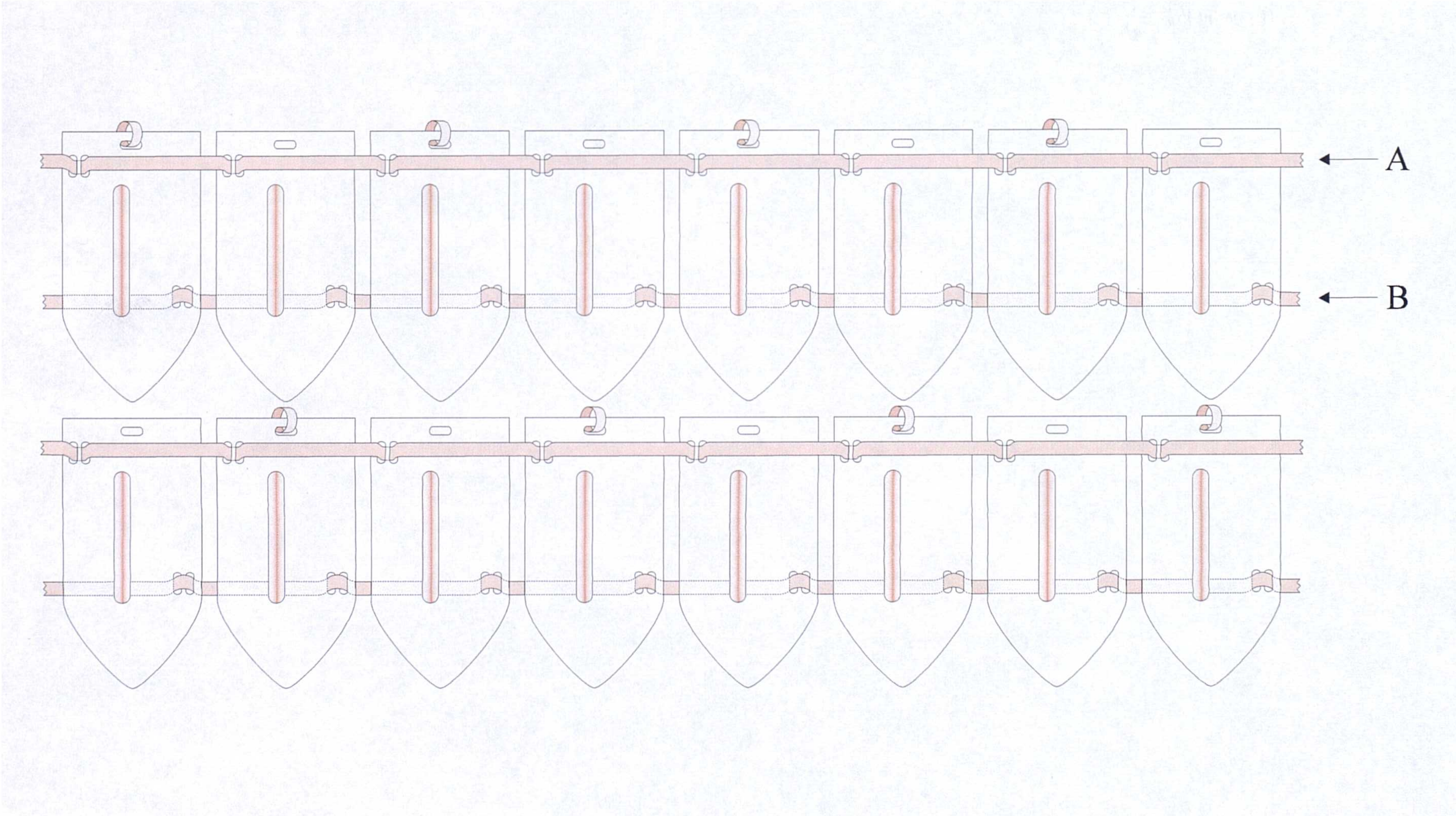
Two possible alignments of overlap of armour scales in the armour fromTut'Ankhamun's tomb

Fig. 44



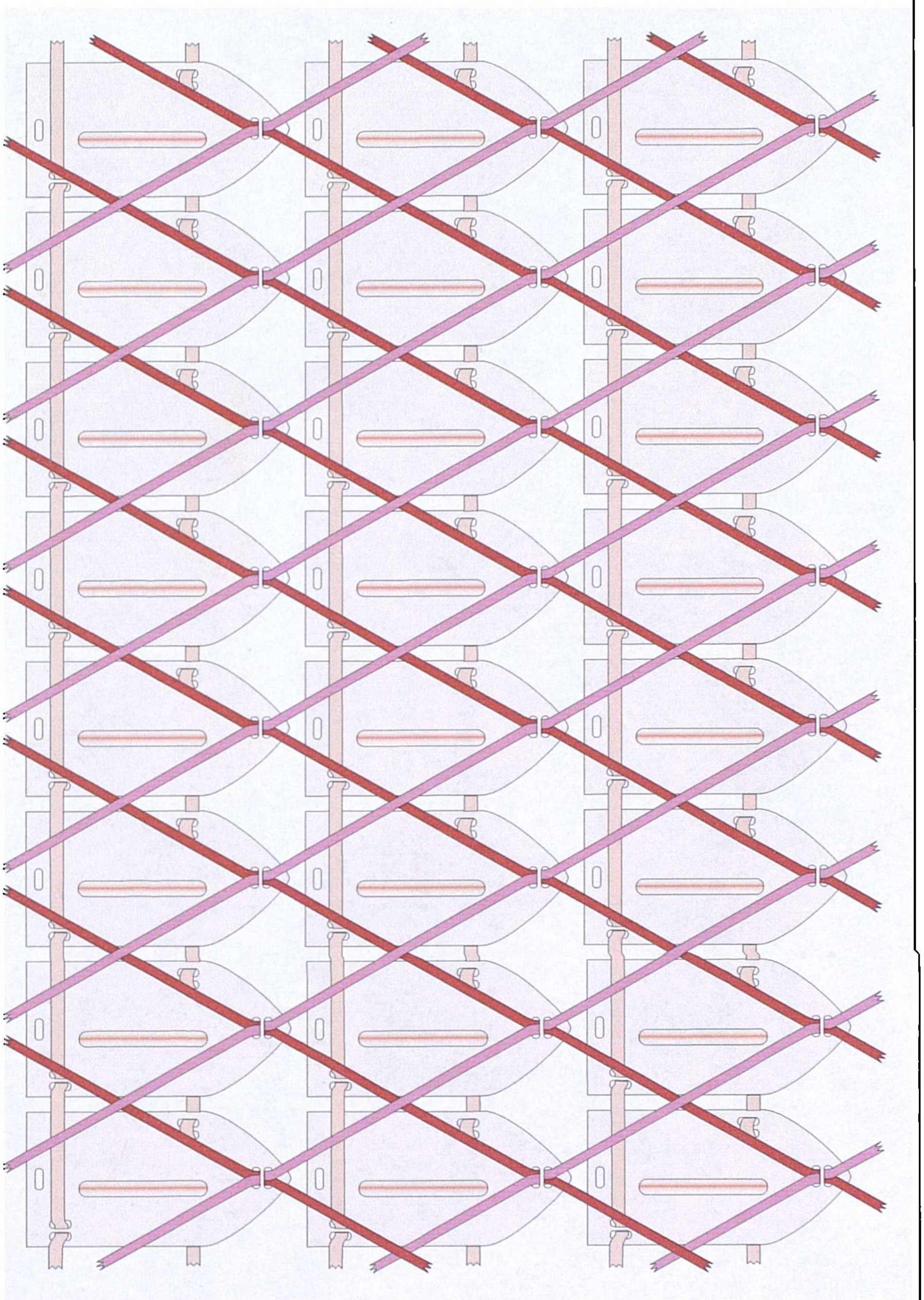
Cross-lacing method of lacing scales with lacing hole pattern 5

Fig. 45



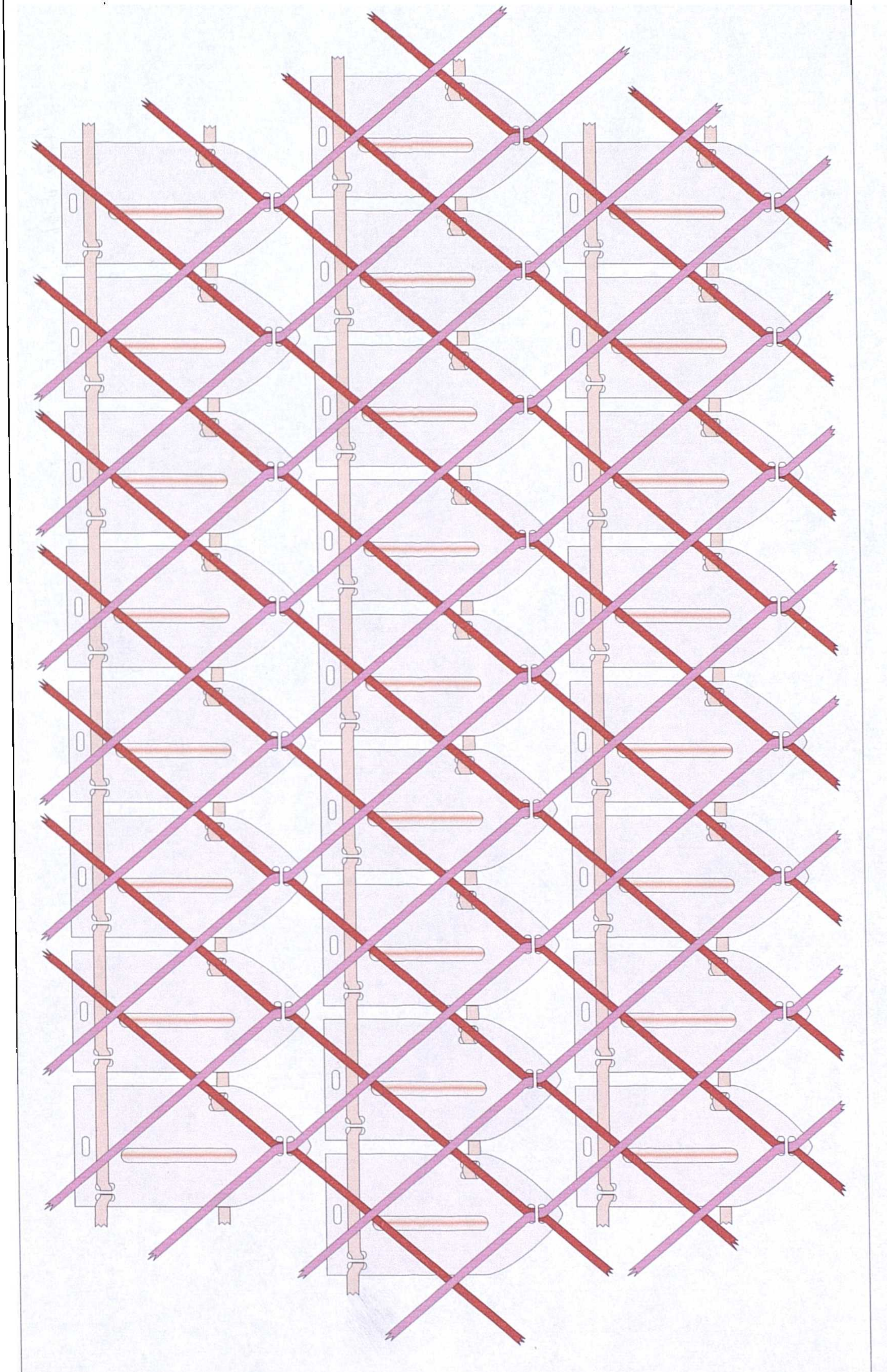
Method of lacing for scales with lacing hole pattern 3

Fig. 46



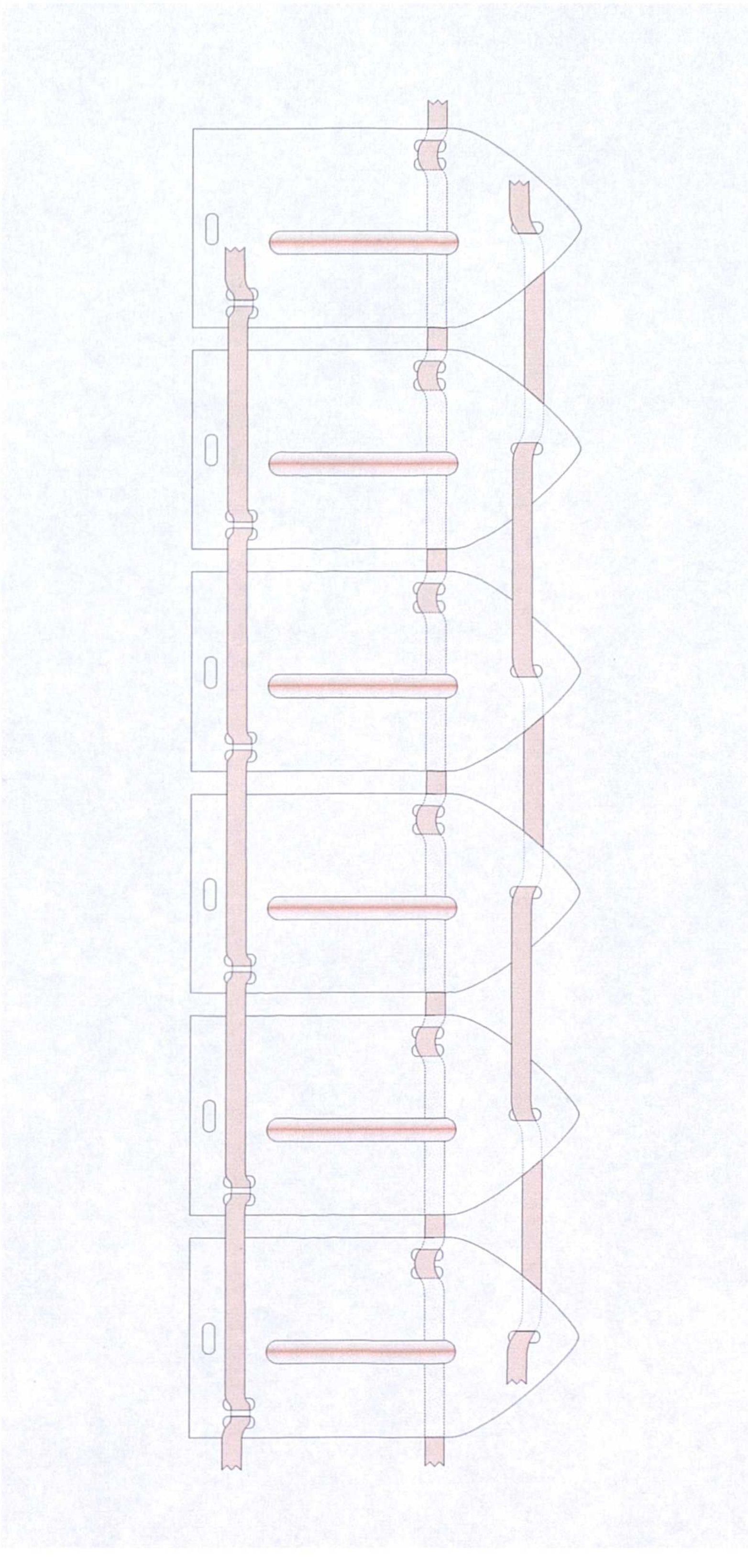
Exploded diagram of cross-lacing scales of lacing pattern 7 where the crossing laces skip one scale

Fig. 47

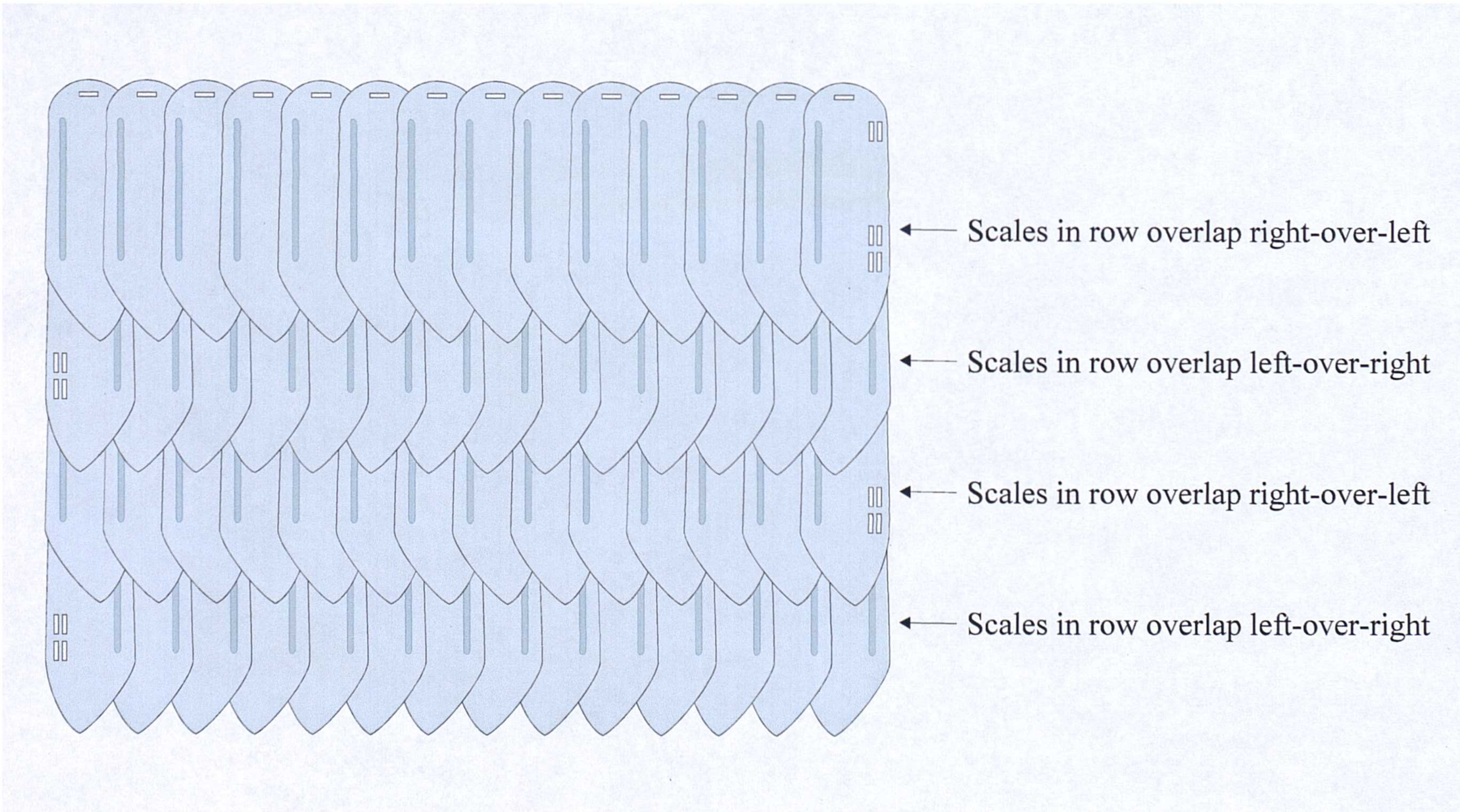


Exploded diagram of cross-lacing scales of lacing pattern 7 where the crossing laces skip two scales

Fig. 48



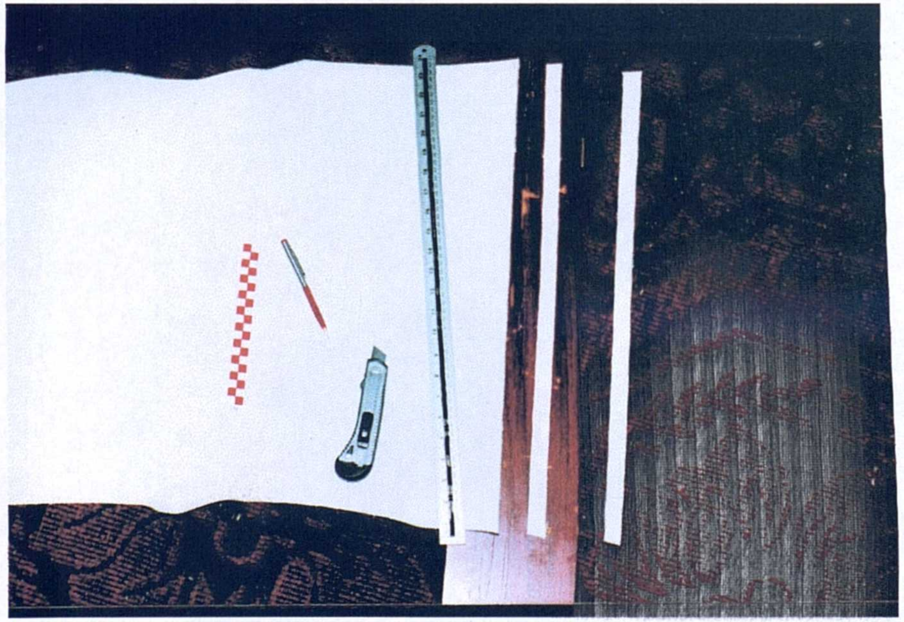
Exploded diagram of the method of lacing the lowest row of scales along the hems of the armour found in the tomb of Tut'Ankhamun.



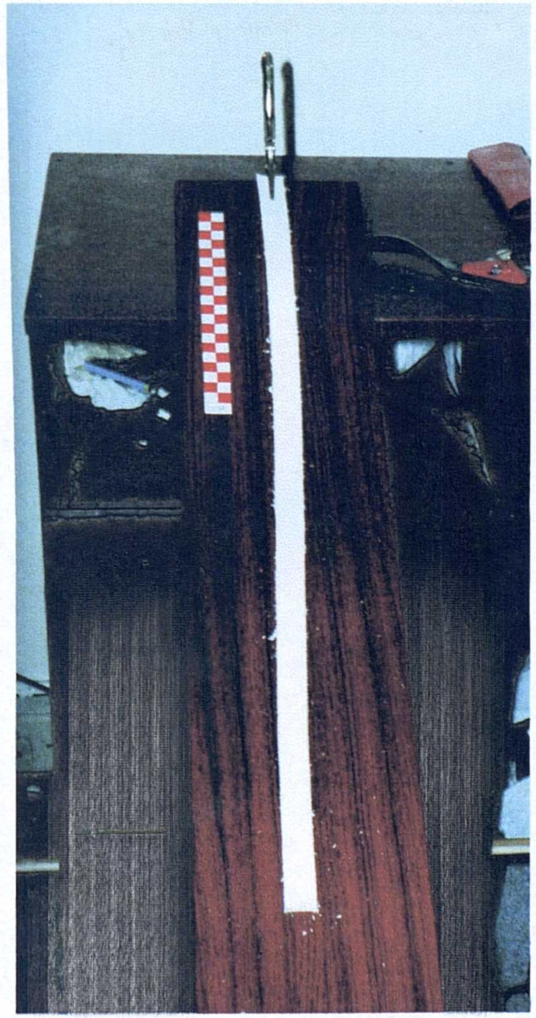
Detail showing the alternating direction of scale overlap in the scale armour from the tomb of Tut'Ankhamun

Fig. 49

Fig. 50



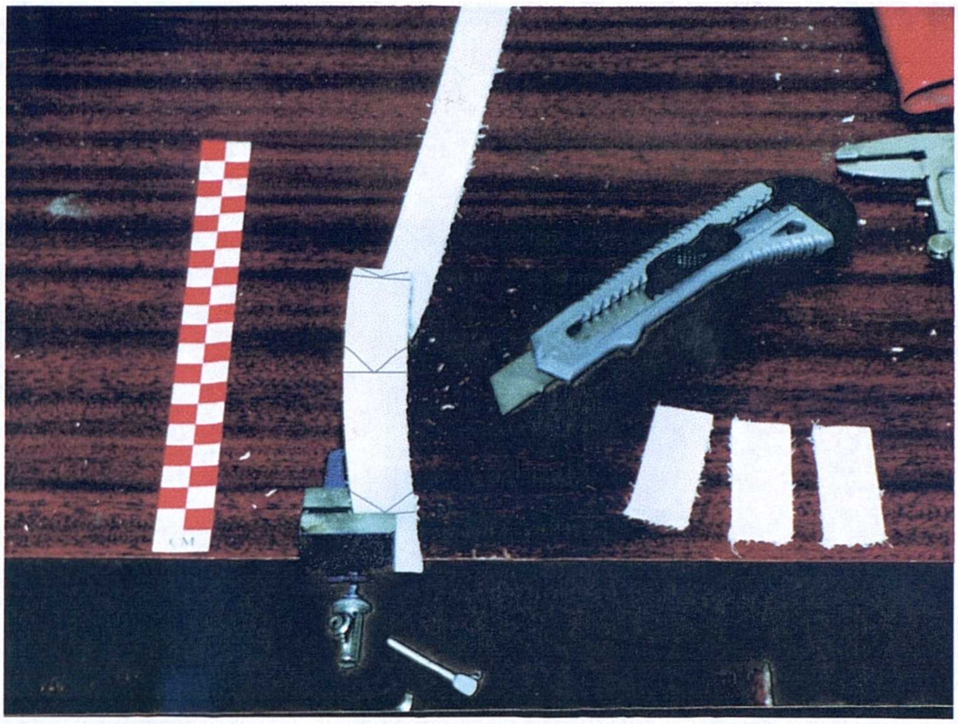
A: Cutting the strips from the tawed leather hide



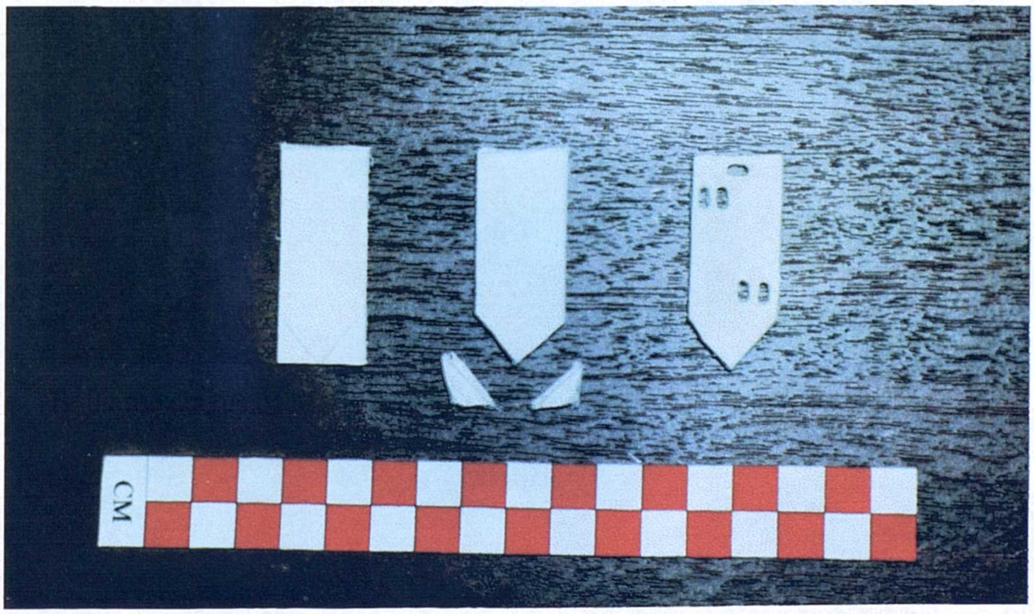
B: Thinning the tawed leather strips to appropriate thickness

Cutting and thinning the tawed leather strips prior to cutting the individual scales

Fig. 51



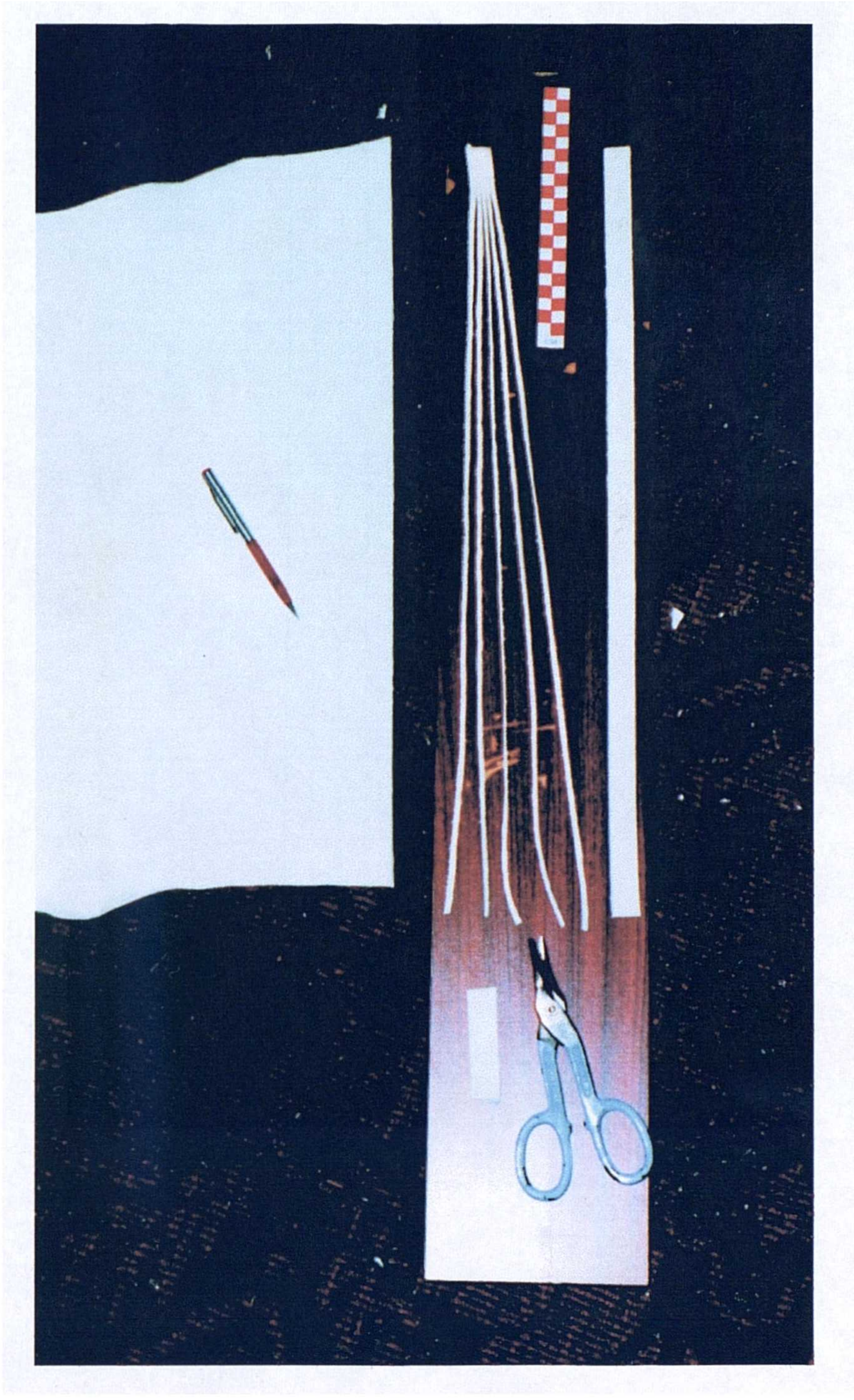
A: Scale shapes marked onto the tawed leather strips and being cut with the vise jaws as a guide



B: Three stages of the manufacture of the tawed leather armour scales

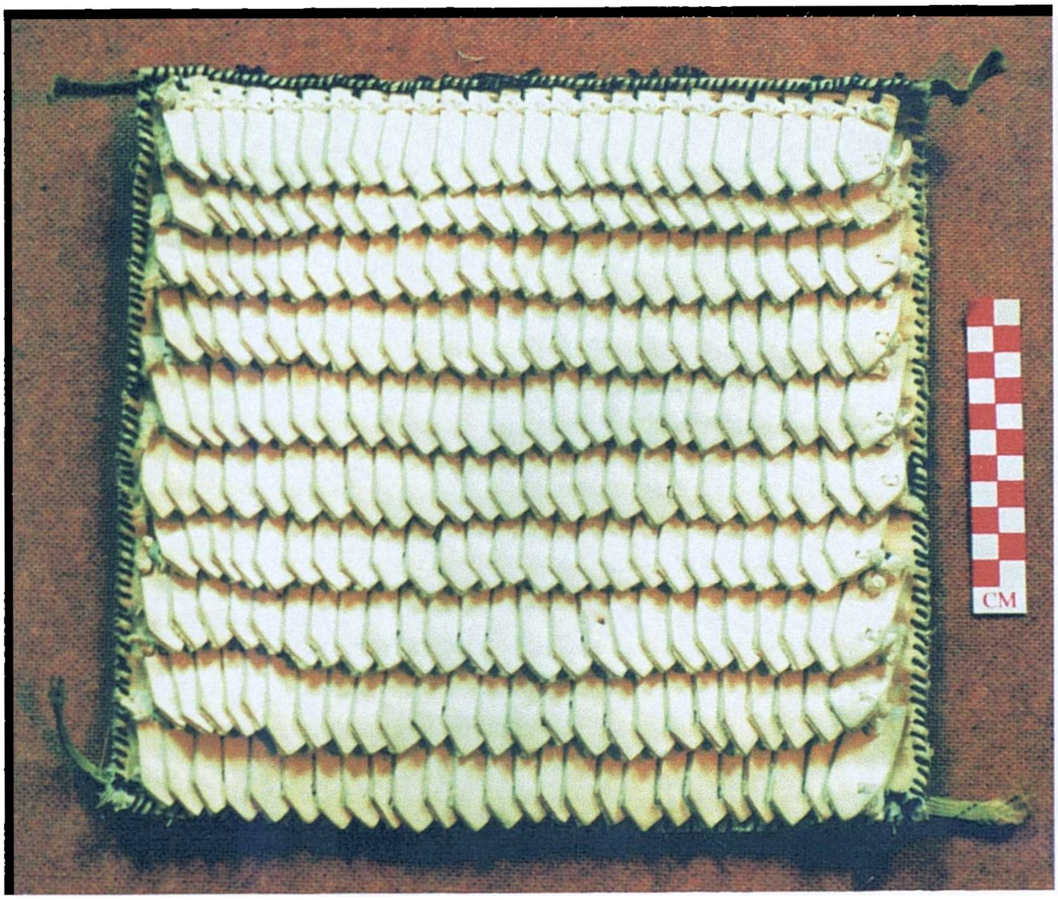
Stages in forming the armour scales from the strips of tawed leather

Fig. 52



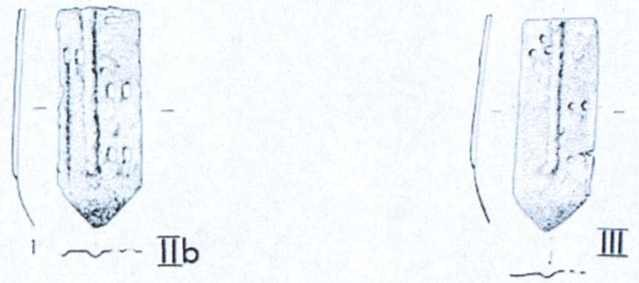
Laces being cut from the tawed leather strips

Fig. 53

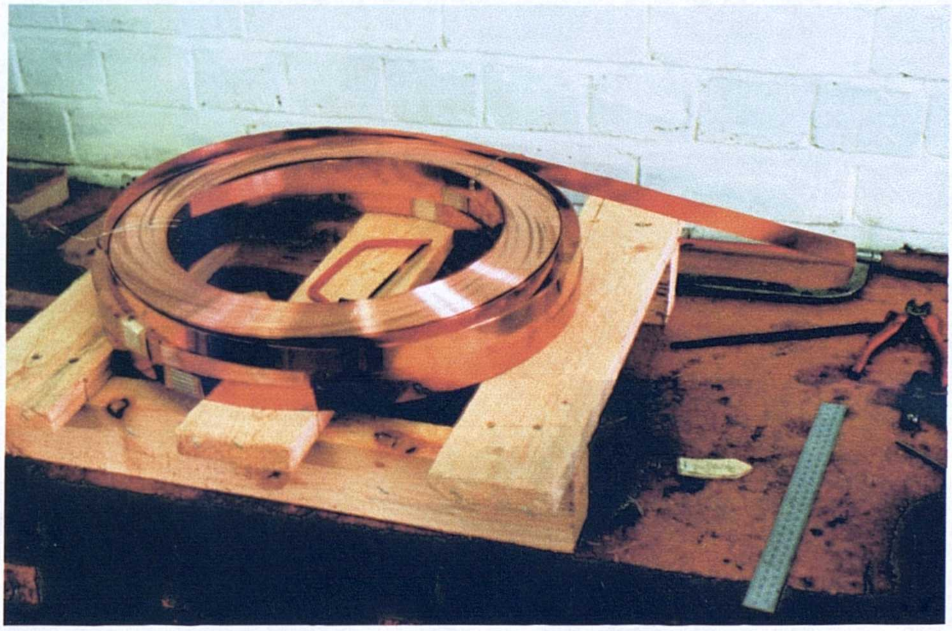


The tawed leather scale armour made for the experimental work at H.M. Royal Armouries Museum

Fig. 54



A: The two types of scales found at Kamid el-Loz, Lebanon, which were combined to form the scale-type used in the experimental work.

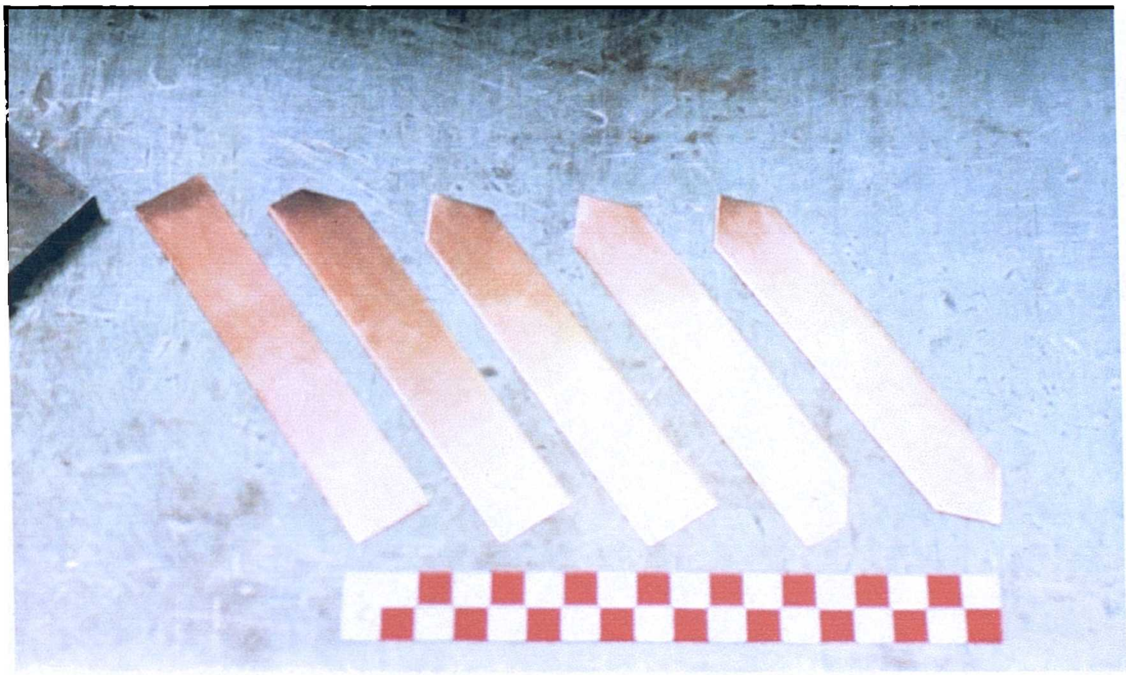


B: The coils of bronze as received from E.I.P. Metals, Birmingham.

The Kamid el-Loz scale types upon which the experimental scales were based, and the coils of bronze metal as received from E.I.P. Metals.

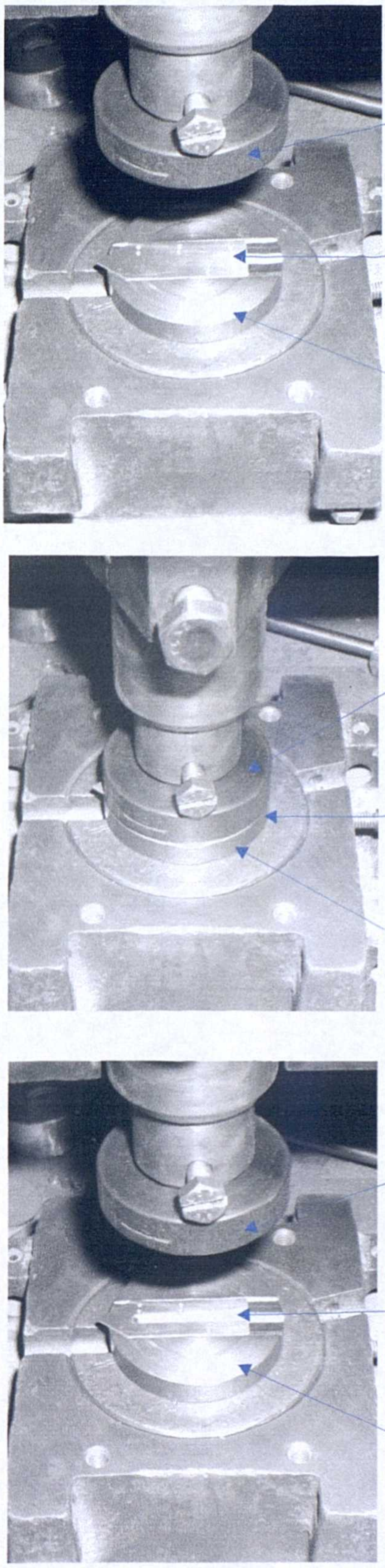
A: Adapted from Ventzke 1986: Pl. 16
B: © T. Hulit 2001

Fig. 55



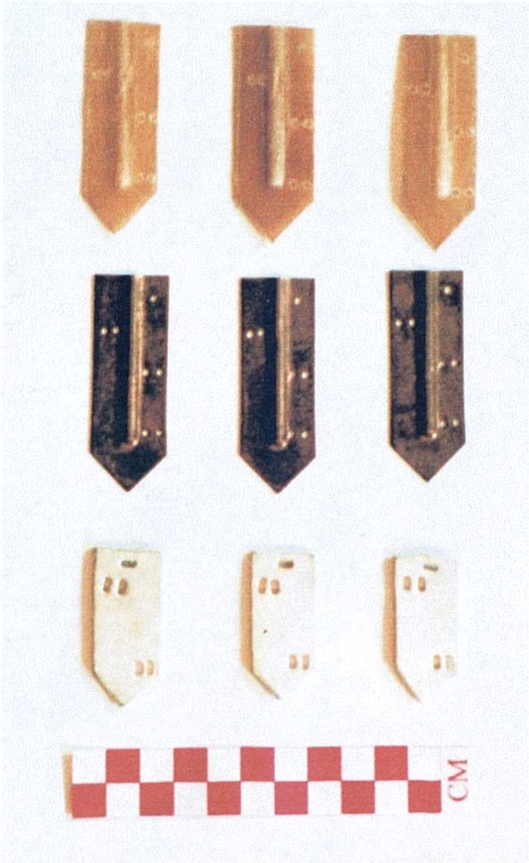
Progressive stages in cutting the points into the bronze armour scale blanks

Fig. 56

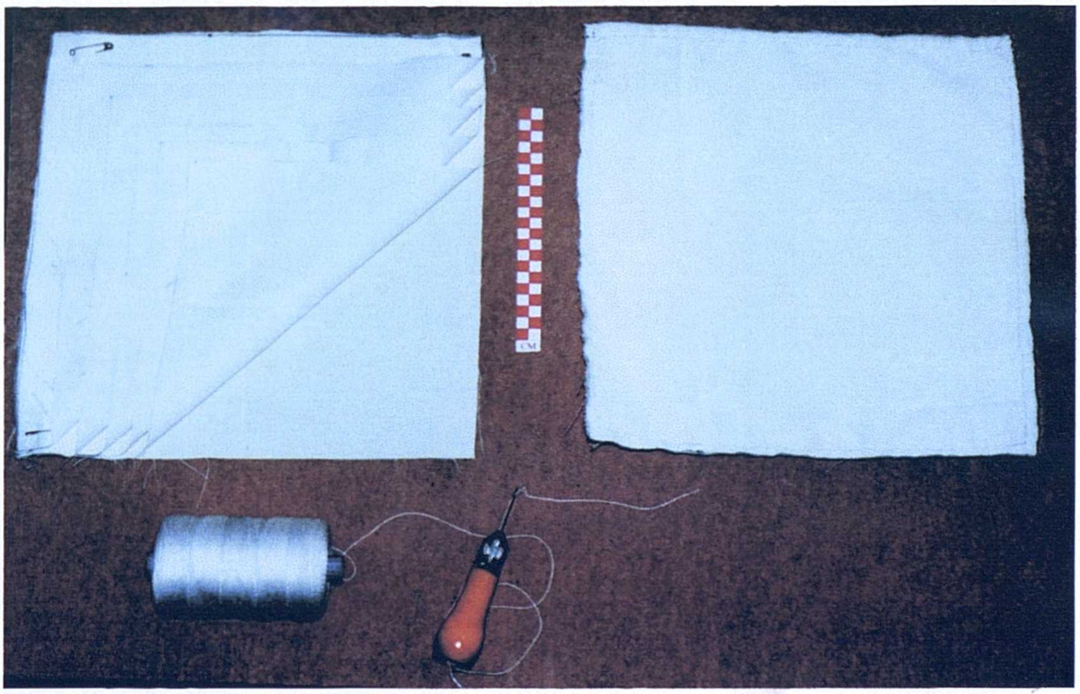


The three stages in the formation of the medial ridge in the armour scales using the fly-press and die

Fig. 57



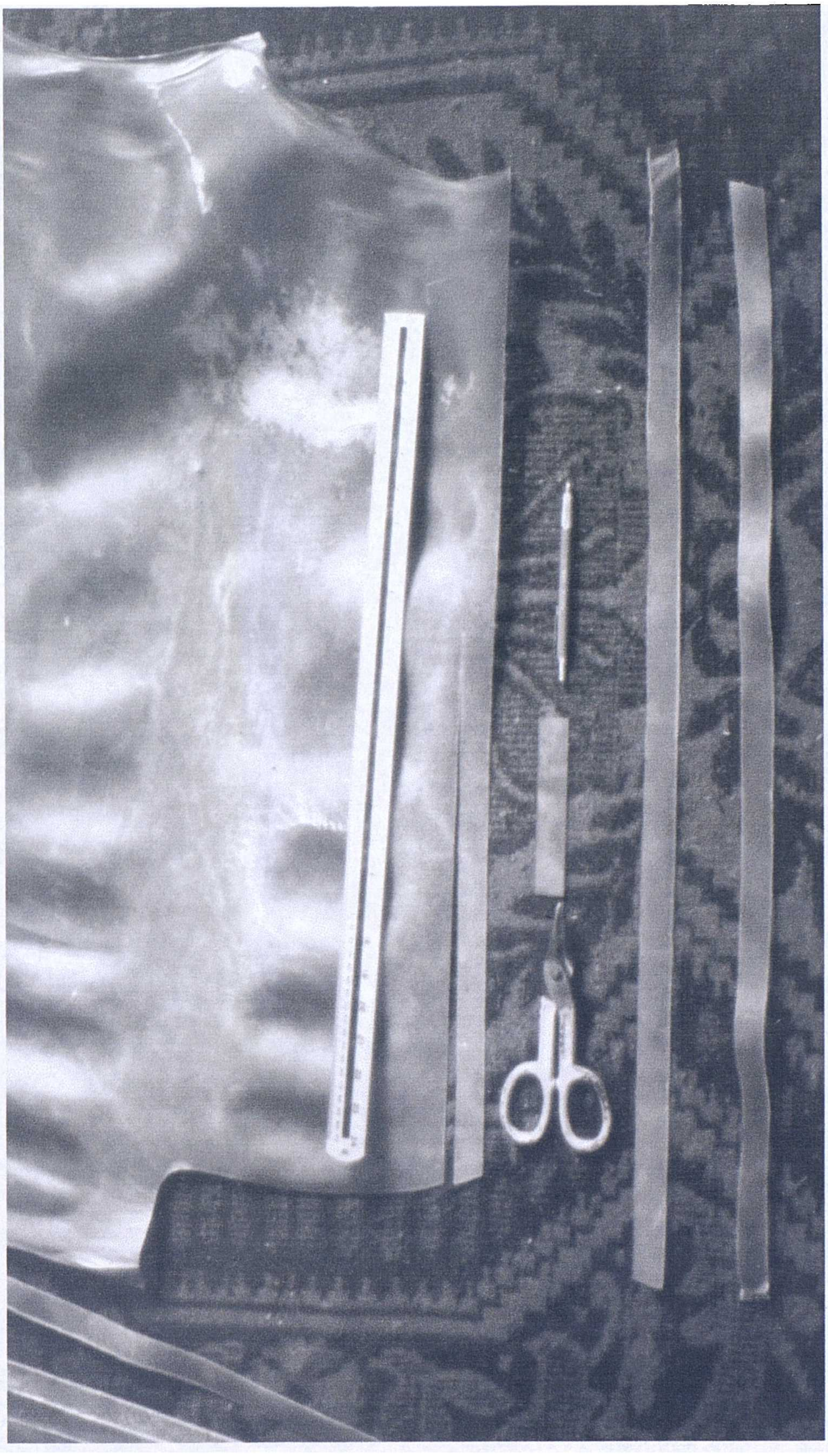
A: Rawhide, bronze, and tawed leather armour scales



B: The manufacture of the linen backing

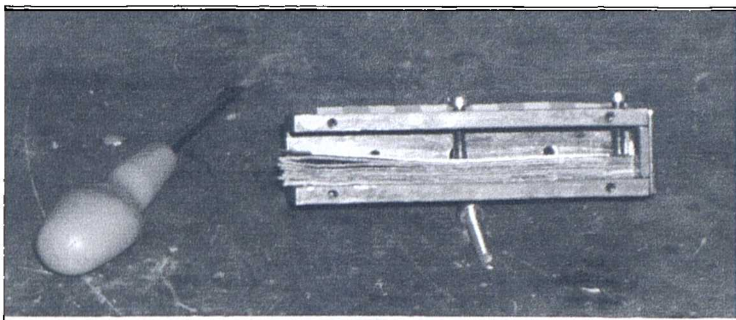
The three types of armour scales and the linen backing used in the manufacture of the scale armour made for the experimental work at H.M. Royal Armouries Museum

Fig. 58



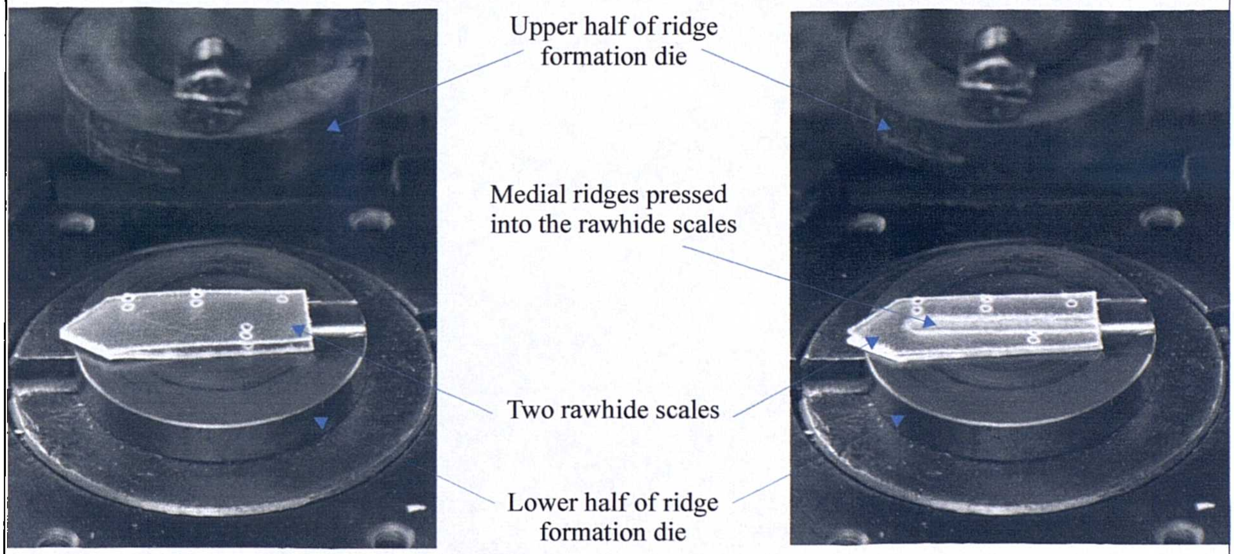
Marking and cutting strips from the rawhide

Fig. 59



A: Eight rawhide double scale-blanks placed into the drilling jig.

B: Eight rawhide double scale-blanks. Four have been cut to final lengths.



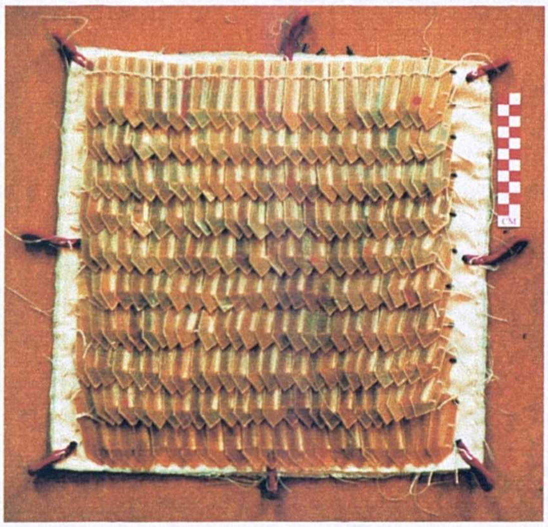
C: Two rawhide scales before medial ridges have been pressed.

D: Two rawhide scales after medial ridges have been pressed.

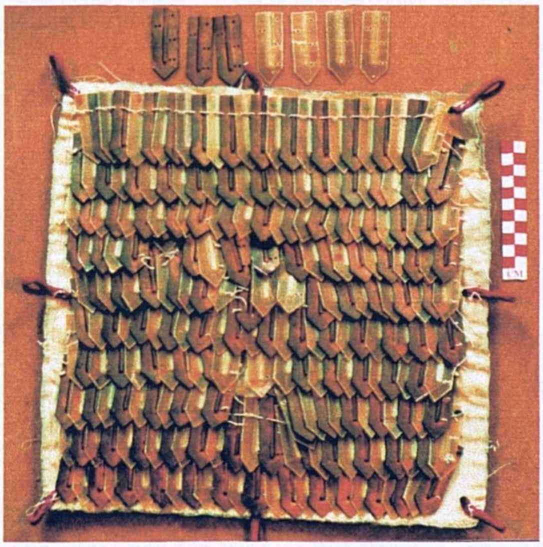
Stages in forming the rawhide armour scales

Fig. 60

A: The section of replica bronze armour



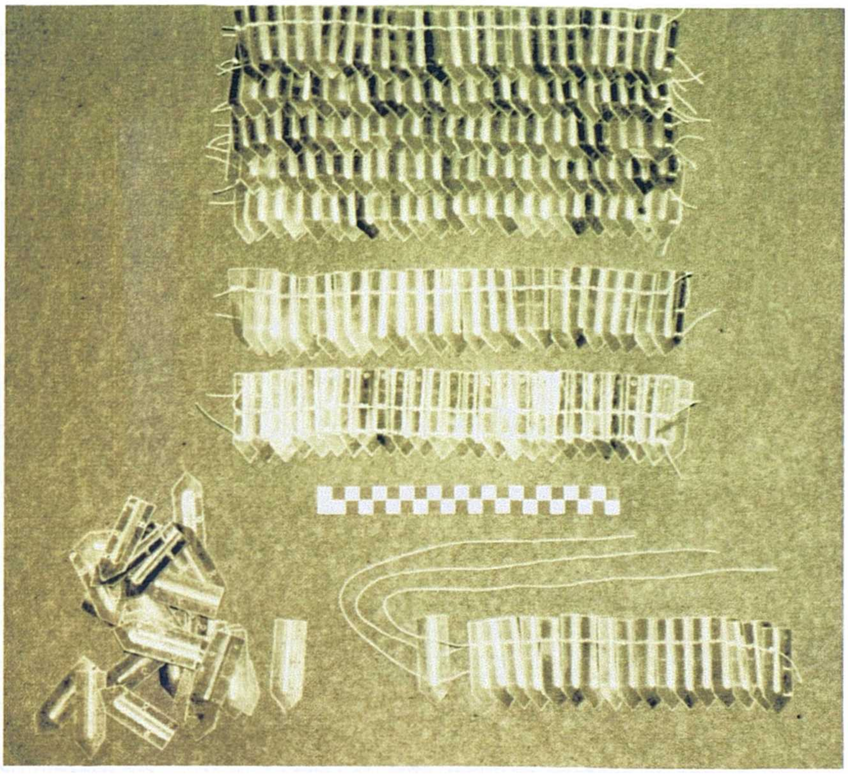
B: The section of replica rawhide armour



C: The section of replica bronze and rawhide composite armour (damaged after being tested)

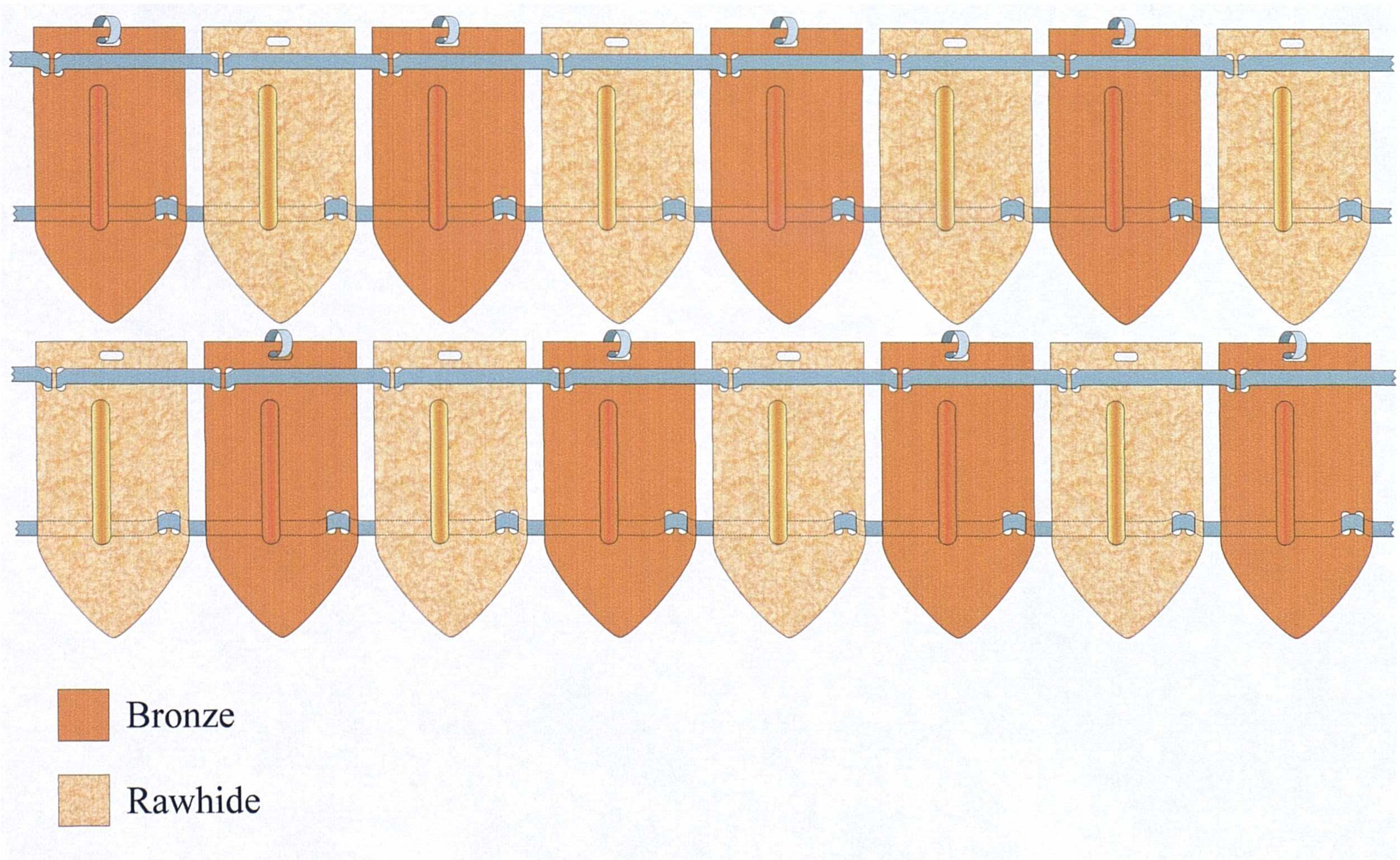
The three sections of replica armour made for the experimental work at H.M. Royal Armouries Museum

Fig. 61



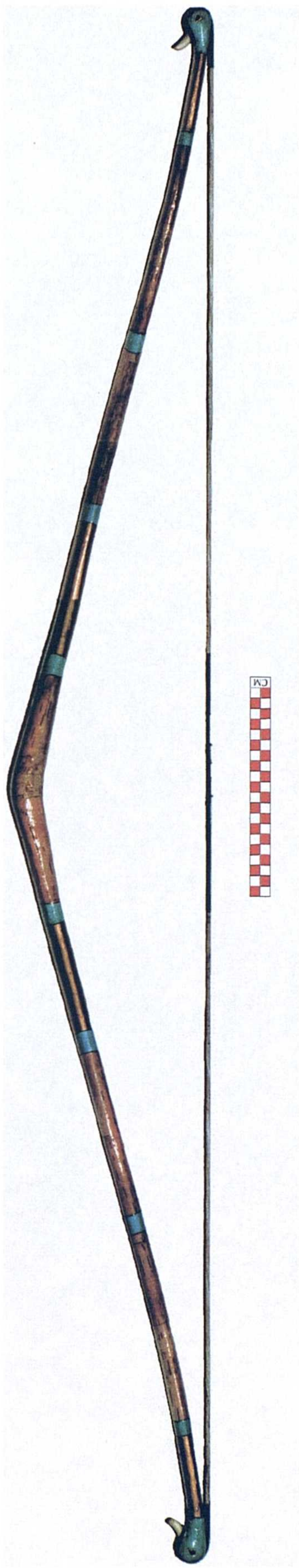
Rawhide armour scales in process of being laced together

Fig. 62



Alternating rawhide and bronze scales in composite armour

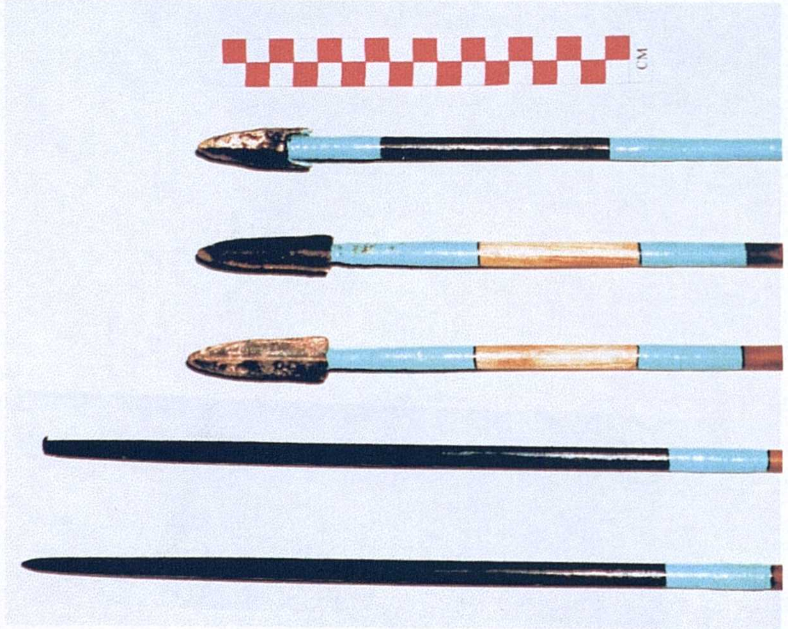
Fig. 63



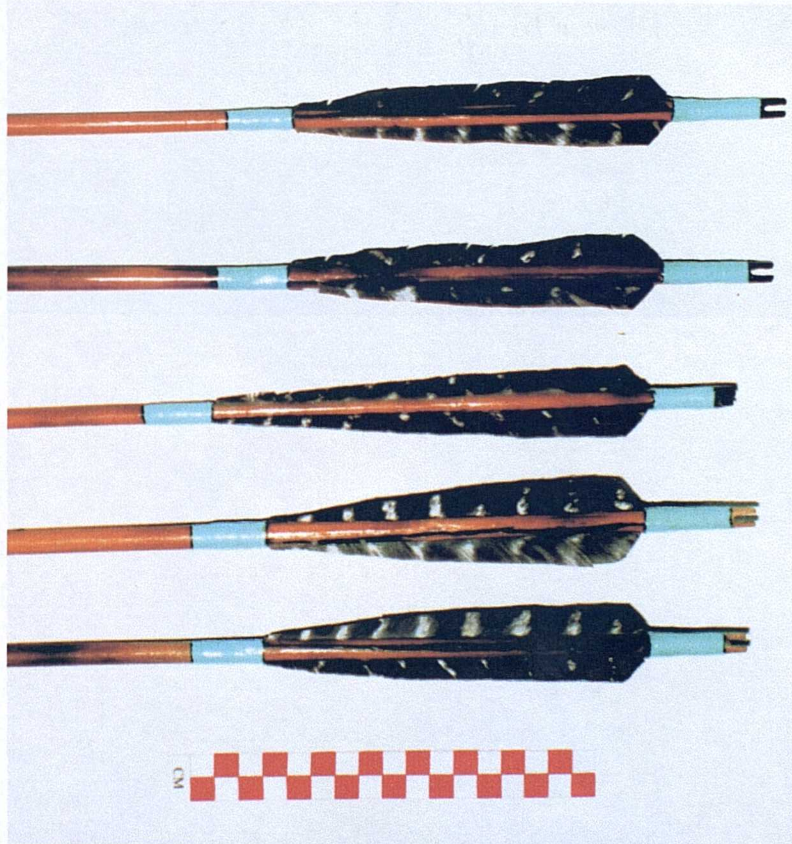
The replica near-eastern angular composite bow made by Edward McEwen, as used in the experimental work

© T. Hulit 1999

Fig. 64



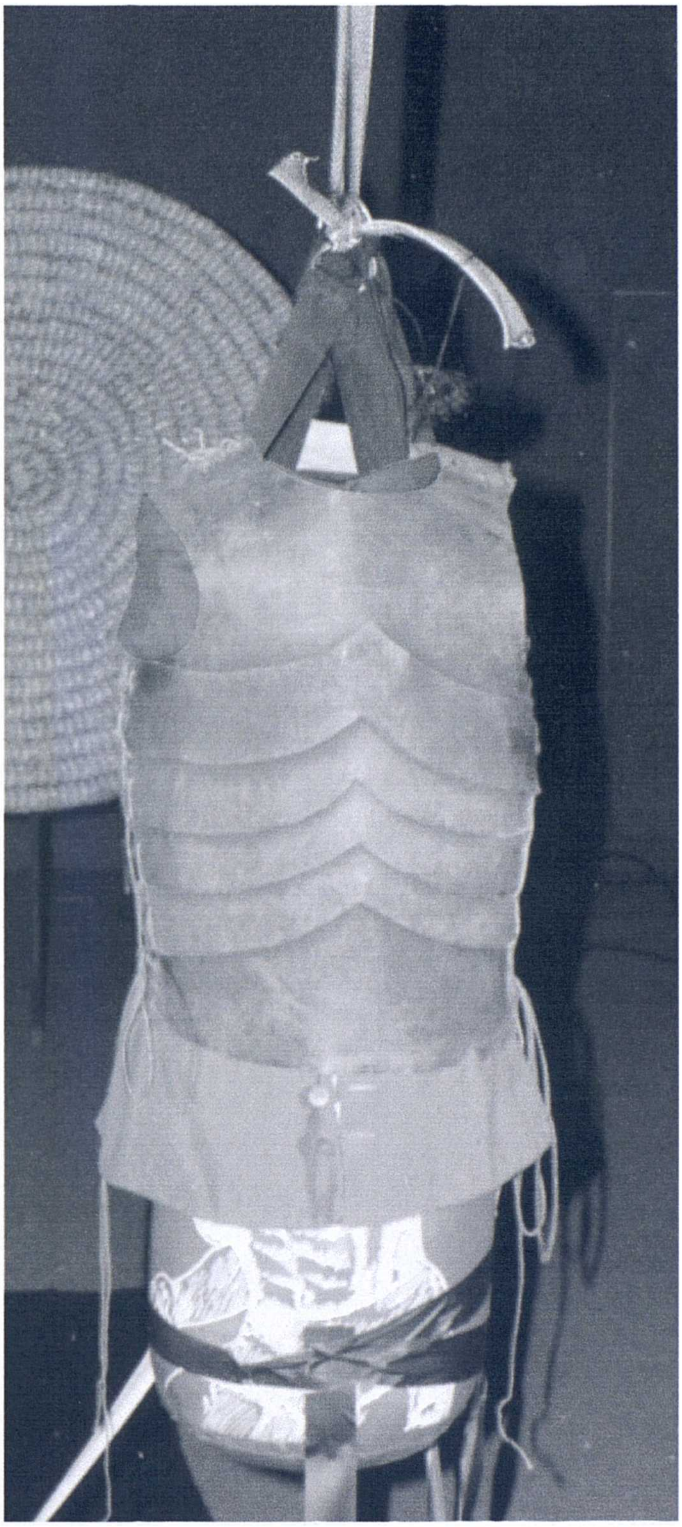
A: McEwen's bronze and ebony arrowheads



B: Fletching on McEwen's arrowheads

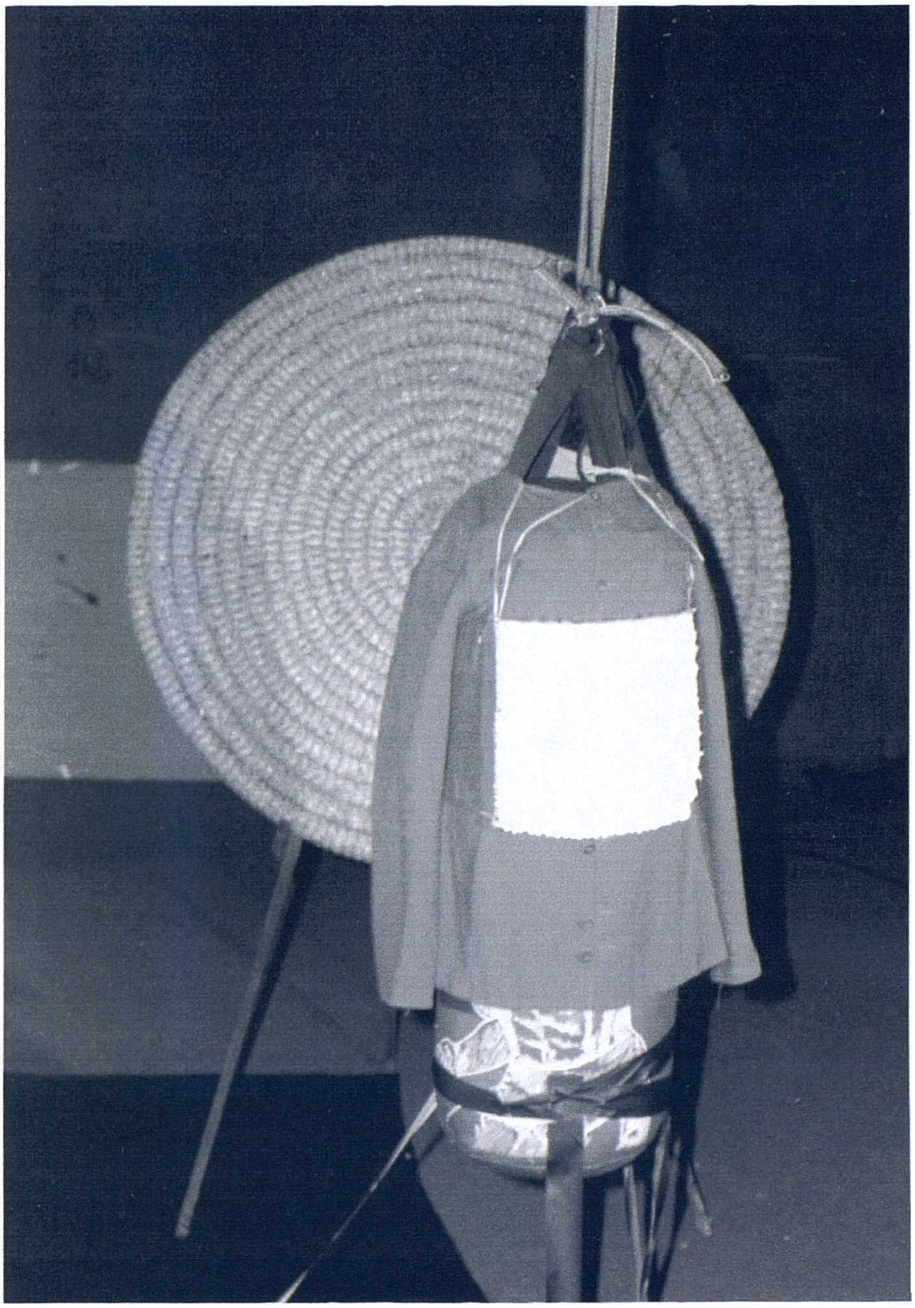
Arrows manufactured by Edward McEwen for the experimental work at H.M. Royals Armouries Museum

Fig. 65



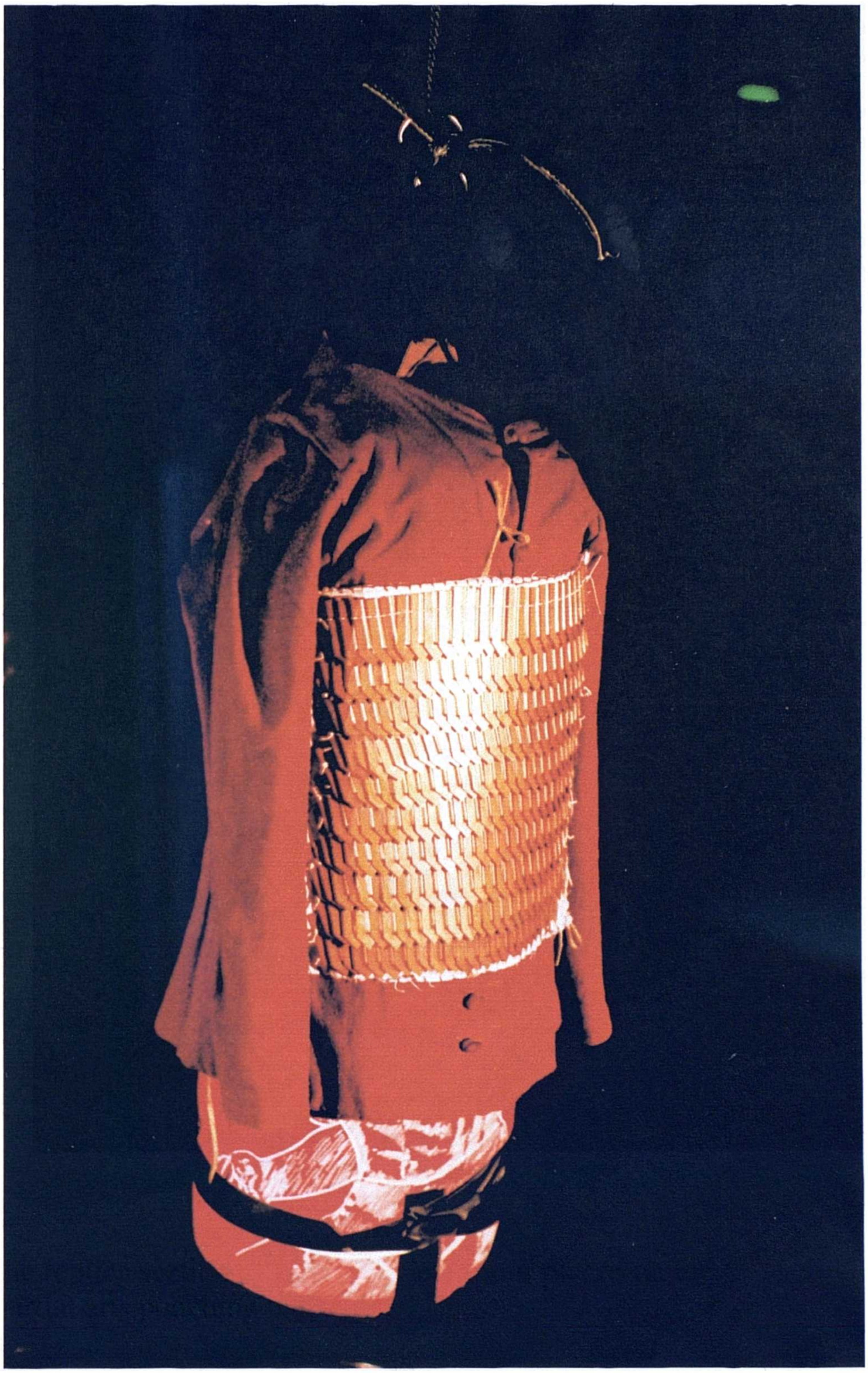
The replica Sea Peoples waxed-leather armour placed on the martial arts punching bag target.

Fig. 66



The replica section of alum-tawed leather scale armour placed on the martial arts punching bag target.

Fig. 67

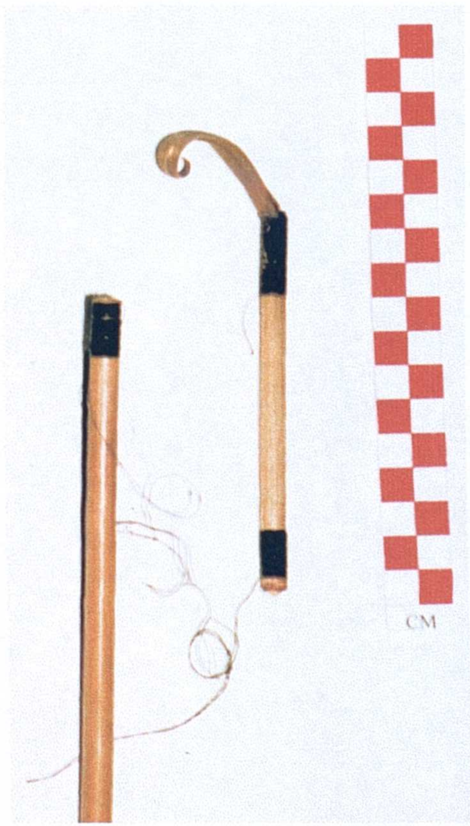


The replica section of bronze scale armour placed on the martial arts punching bag target.

Fig. 68

A

Arrow #7
Shot at bronze armour

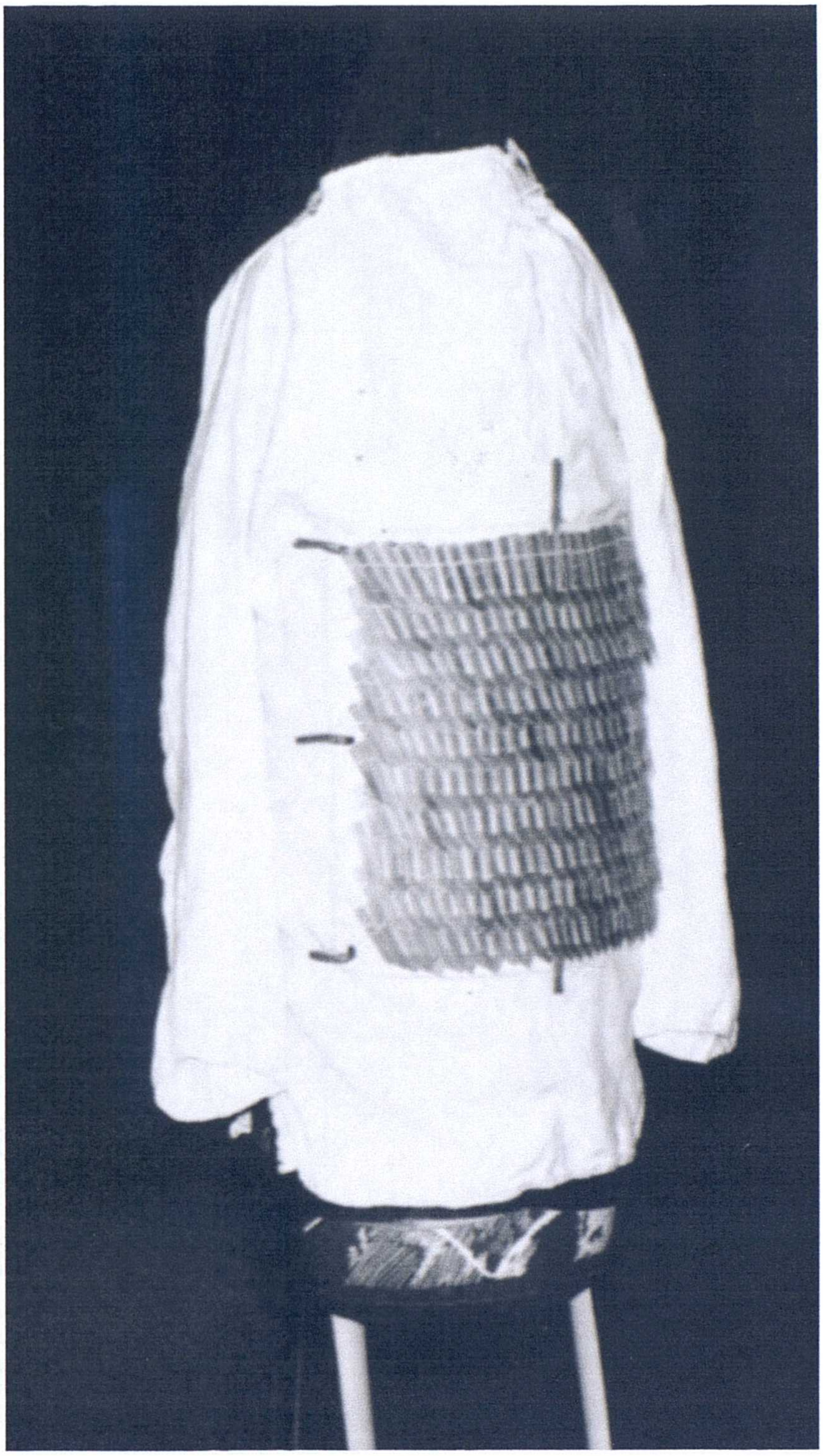


B

Arrow #10
Shot at bronze armour

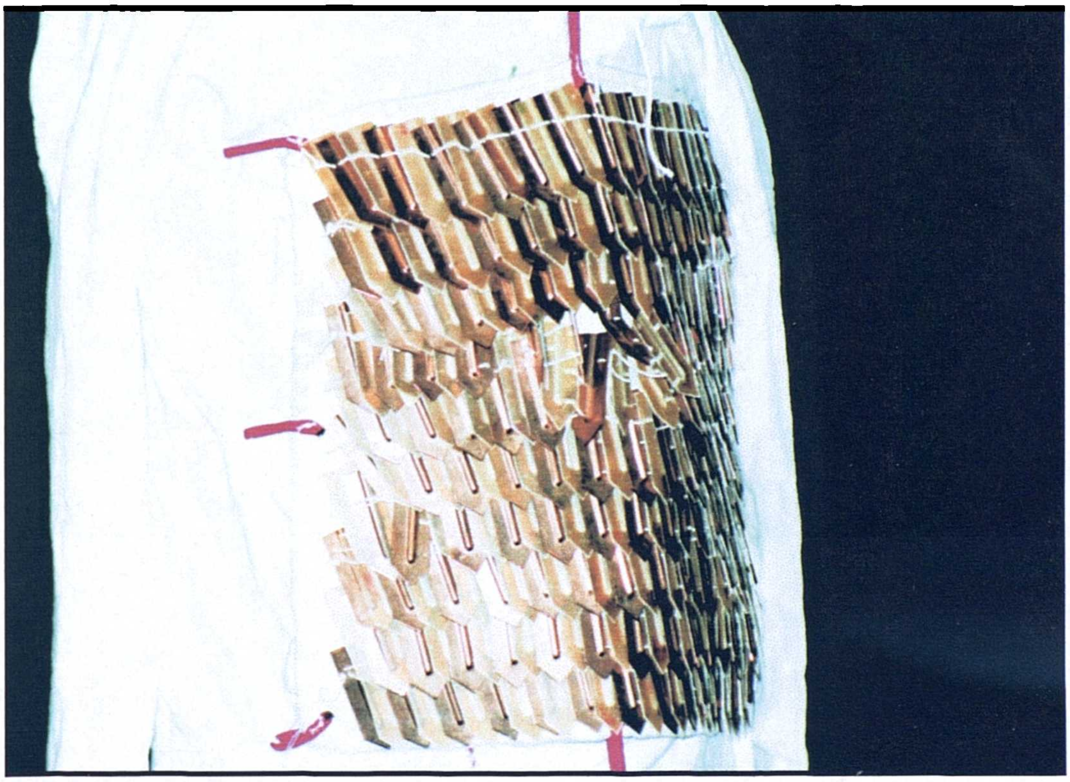
Two arrows shot at the bronze armour during tests conducted at H.M. Royal Armouries Museum

Fig. 69



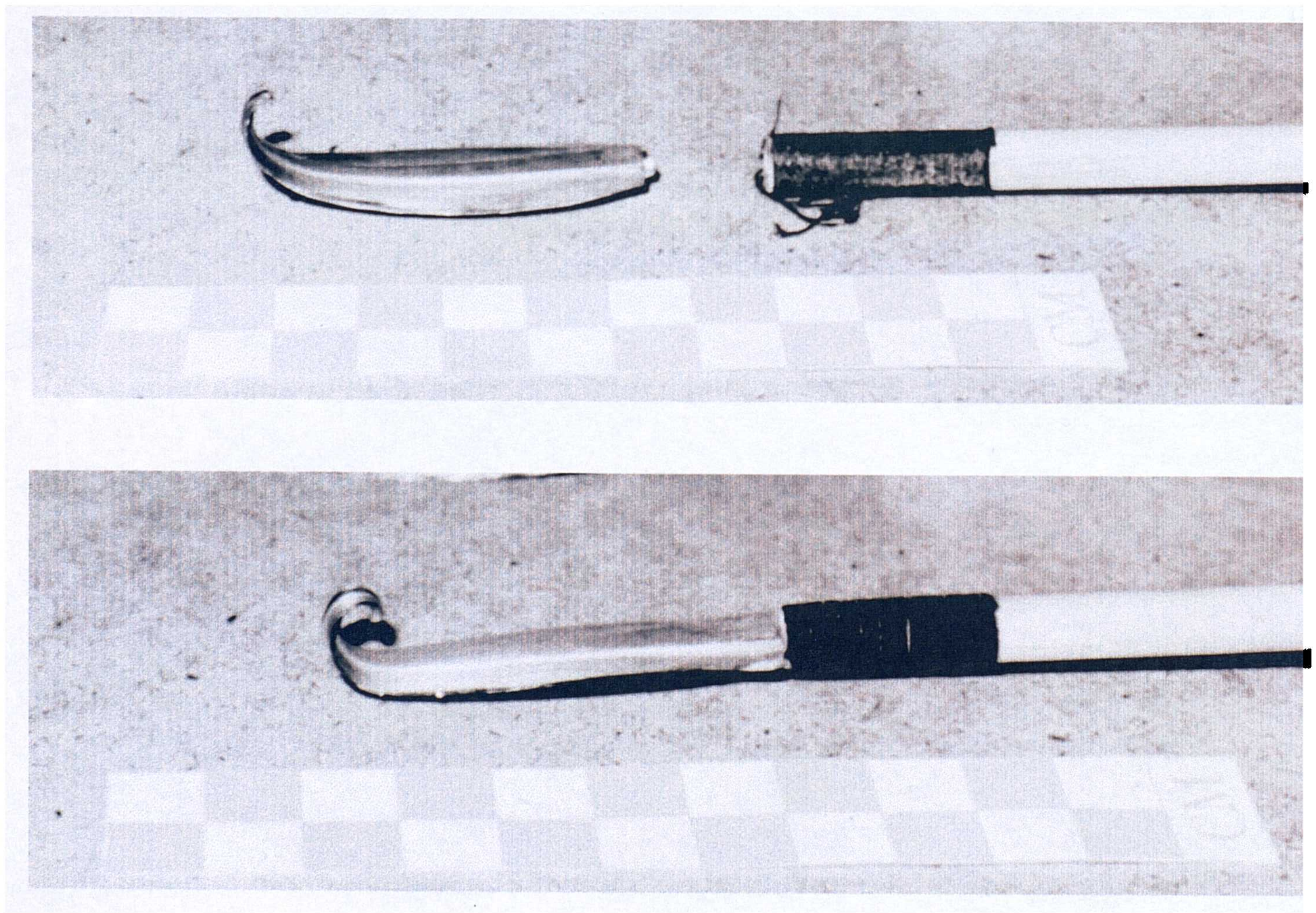
The replica section of rawhide scale armour placed on the martial arts punching bag target.

Fig. 70



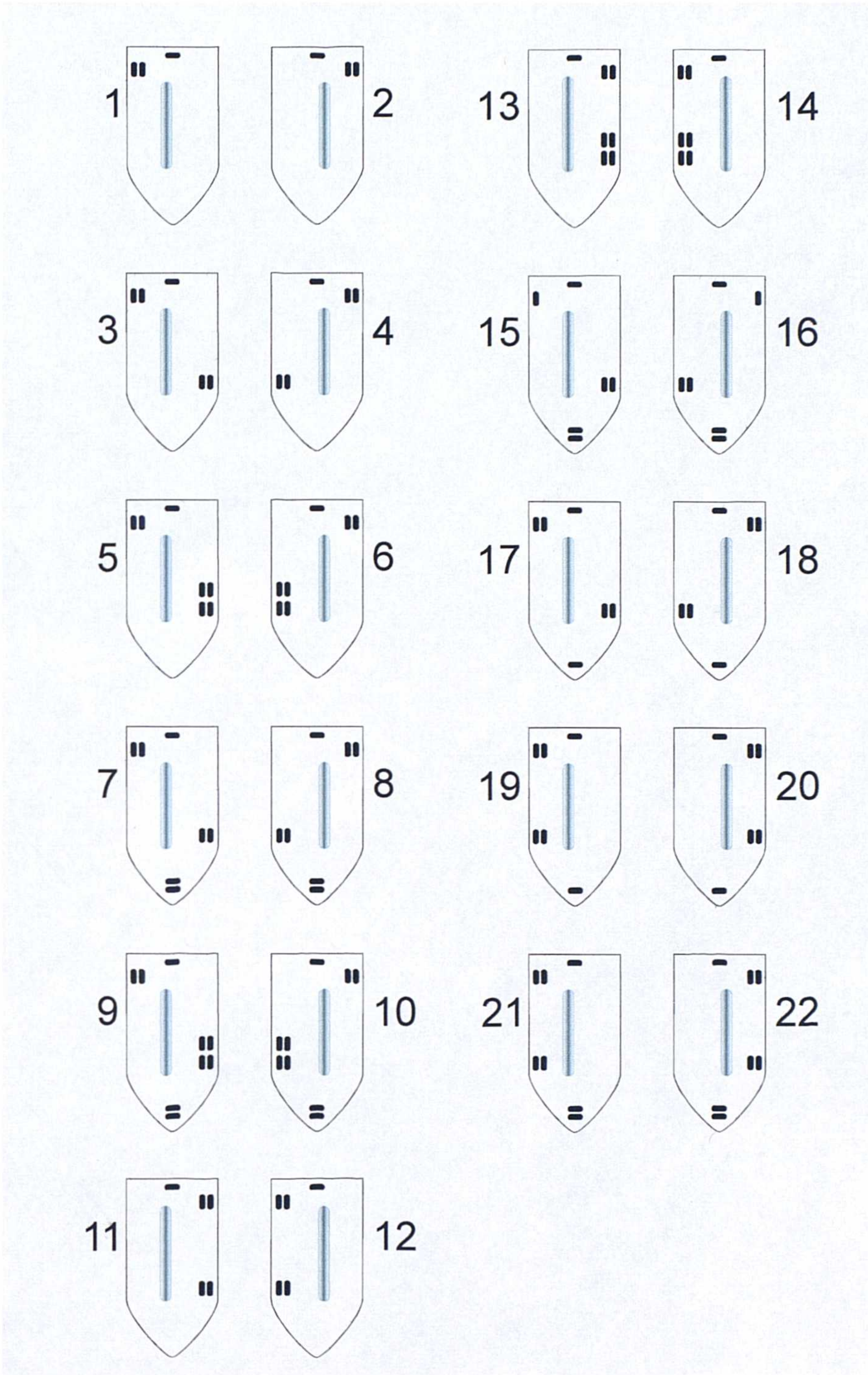
The replica section of composite scale armour placed on the martial arts punching bag target (showing some damage)

Fig. 71



Two arrows shot at the composite armour during tests conducted at H.M. Royal Armouries Museum

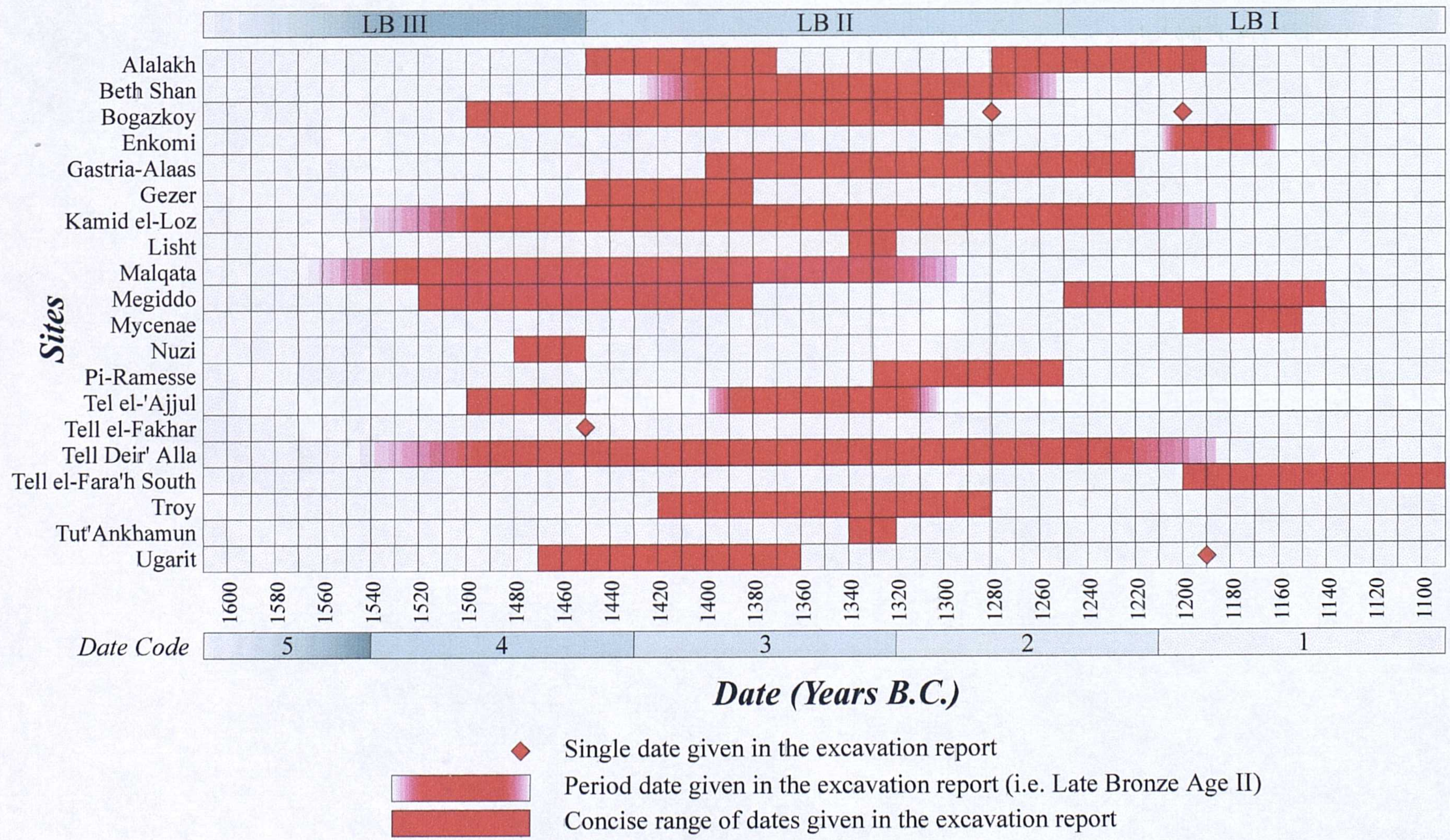
Fig. 72



Lacing Pattern 0 ("zero") indicates an unperforated armour scale
Lacing Pattern BR indicates a scale which is broken and thus prevents the identification of lacing pattern
Lacing Pattern IR indicates a scale with an irregular lacing pattern
Lacing Pattern U indicates a scale for which there is no information concerning the lacing pattern

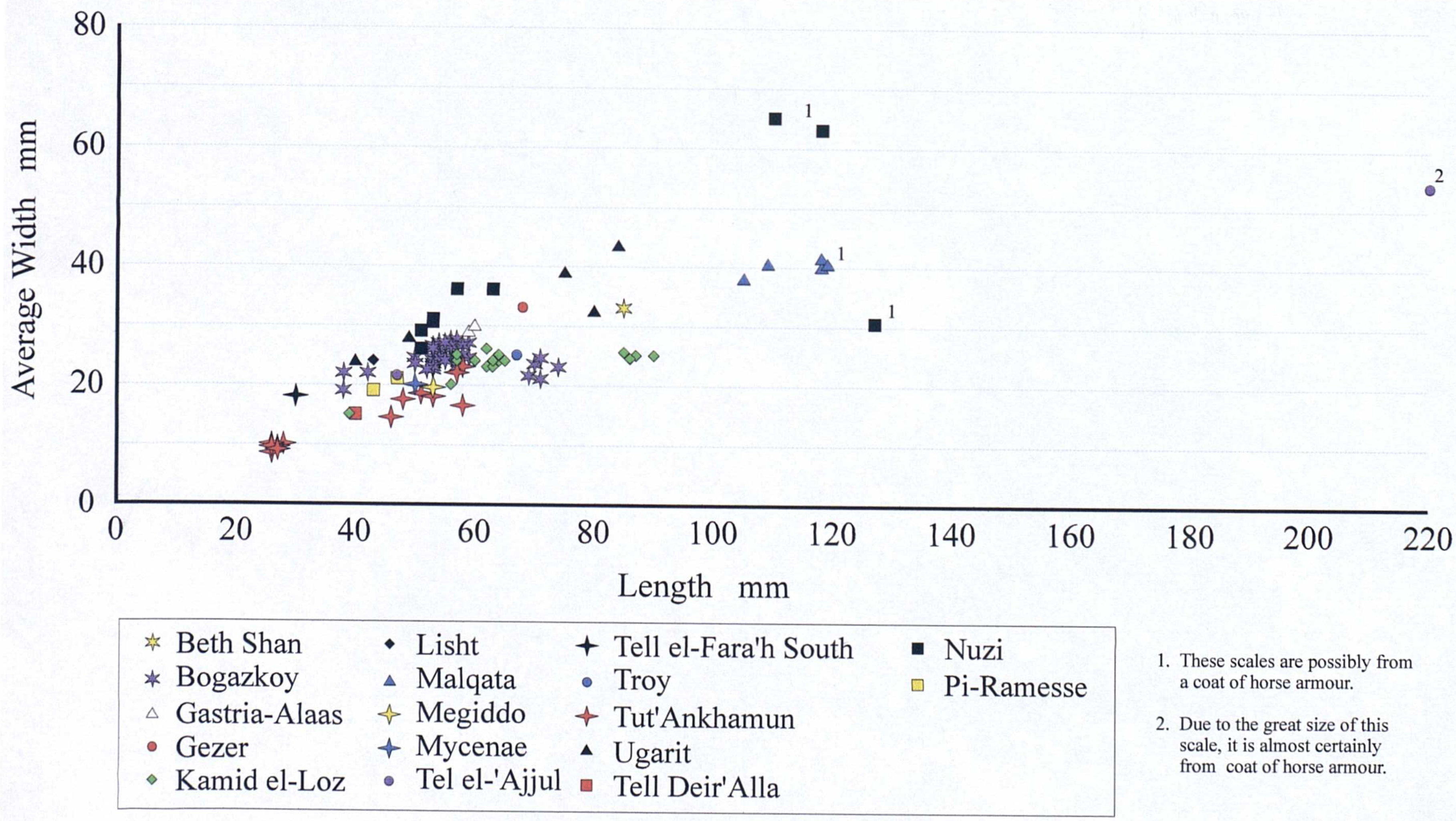
Possible patterns of lacing holes in Late Bronze Age armour scales

Fig. 73



Archaeological Sites compared with the Date Codes

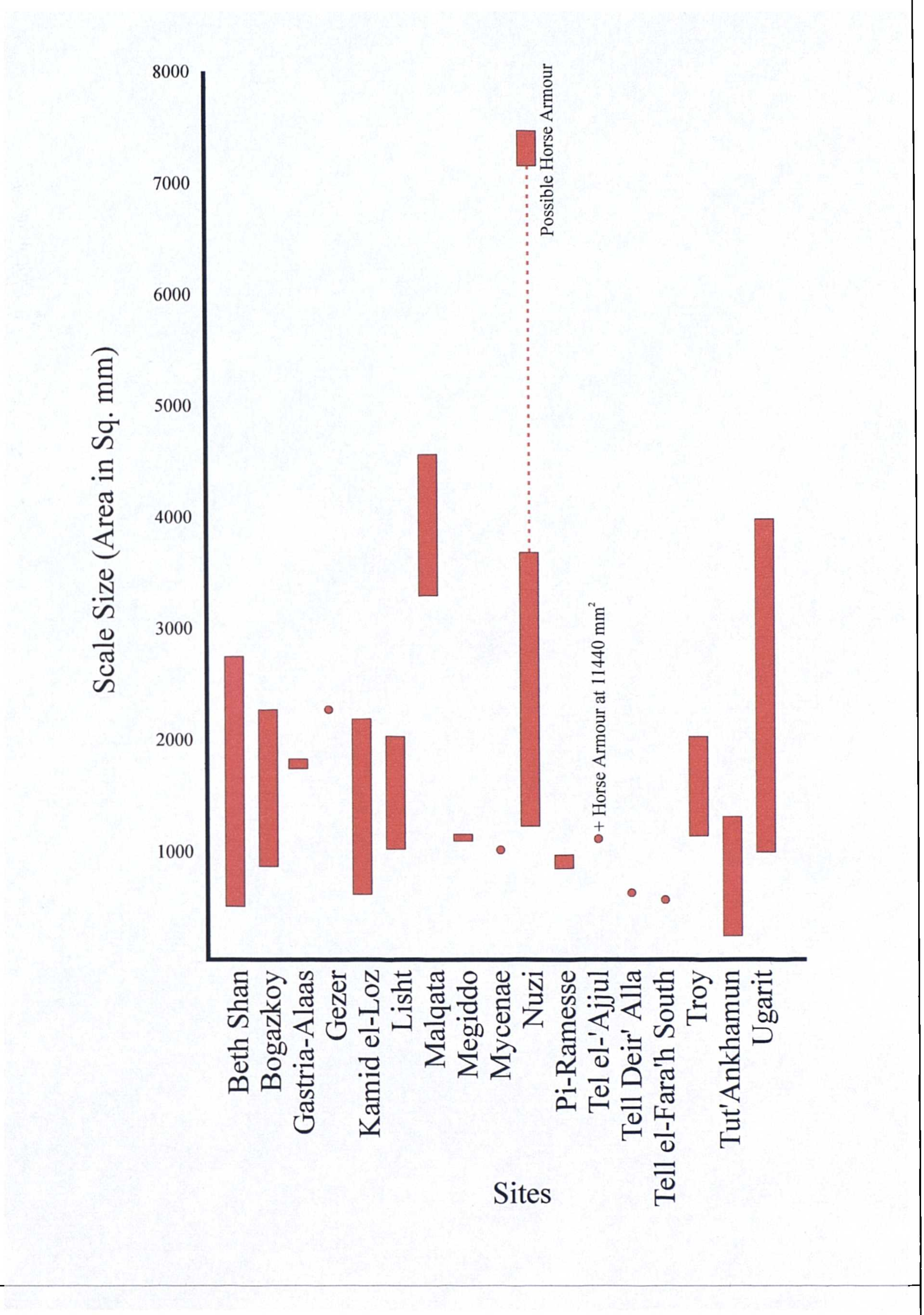
Fig. 74



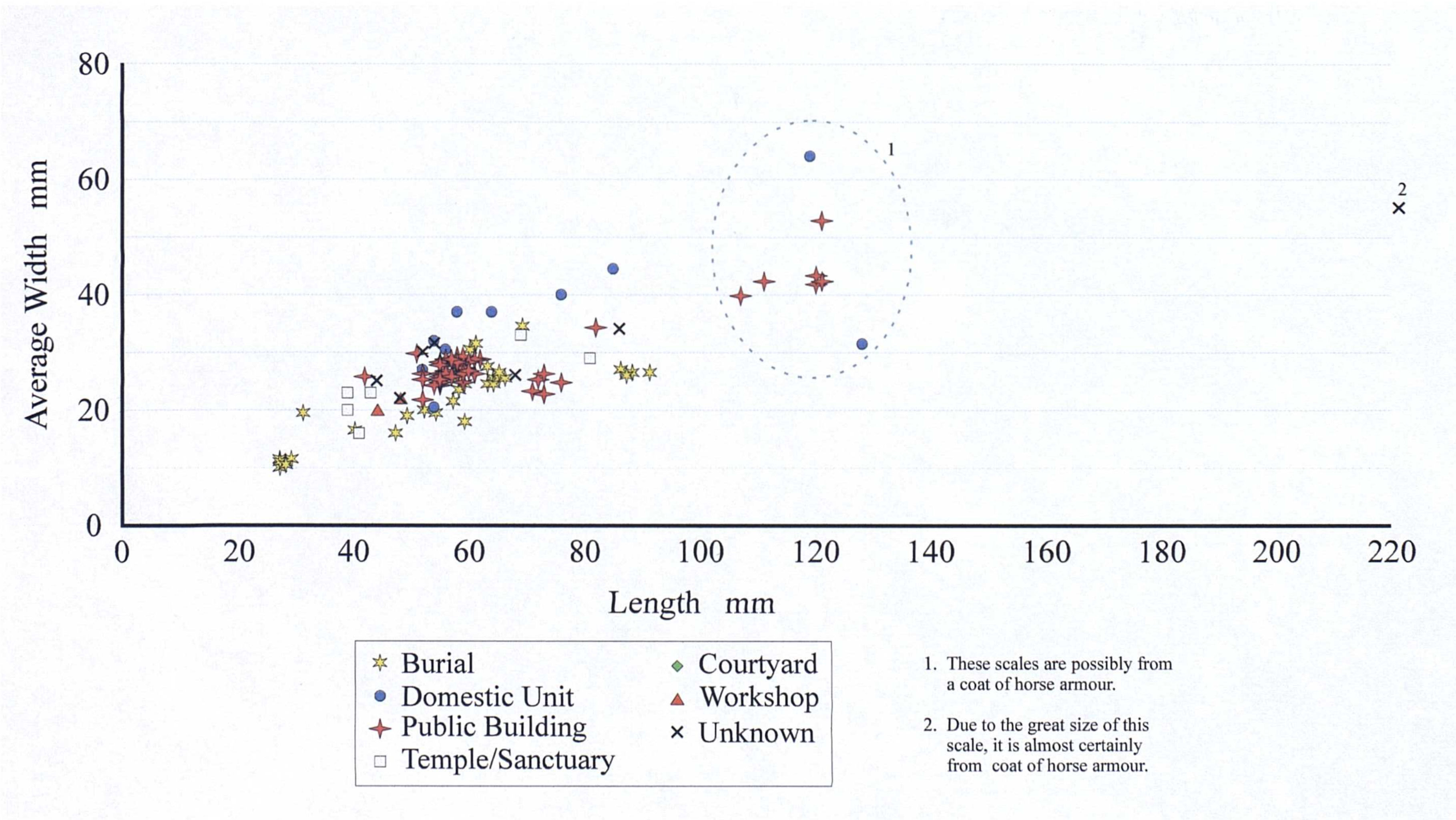
1. These scales are possibly from a coat of horse armour.
2. Due to the great size of this scale, it is almost certainly from coat of horse armour.

Length-to-Width Ratio of the armour scales for each Archaeological Site

Fig. 75



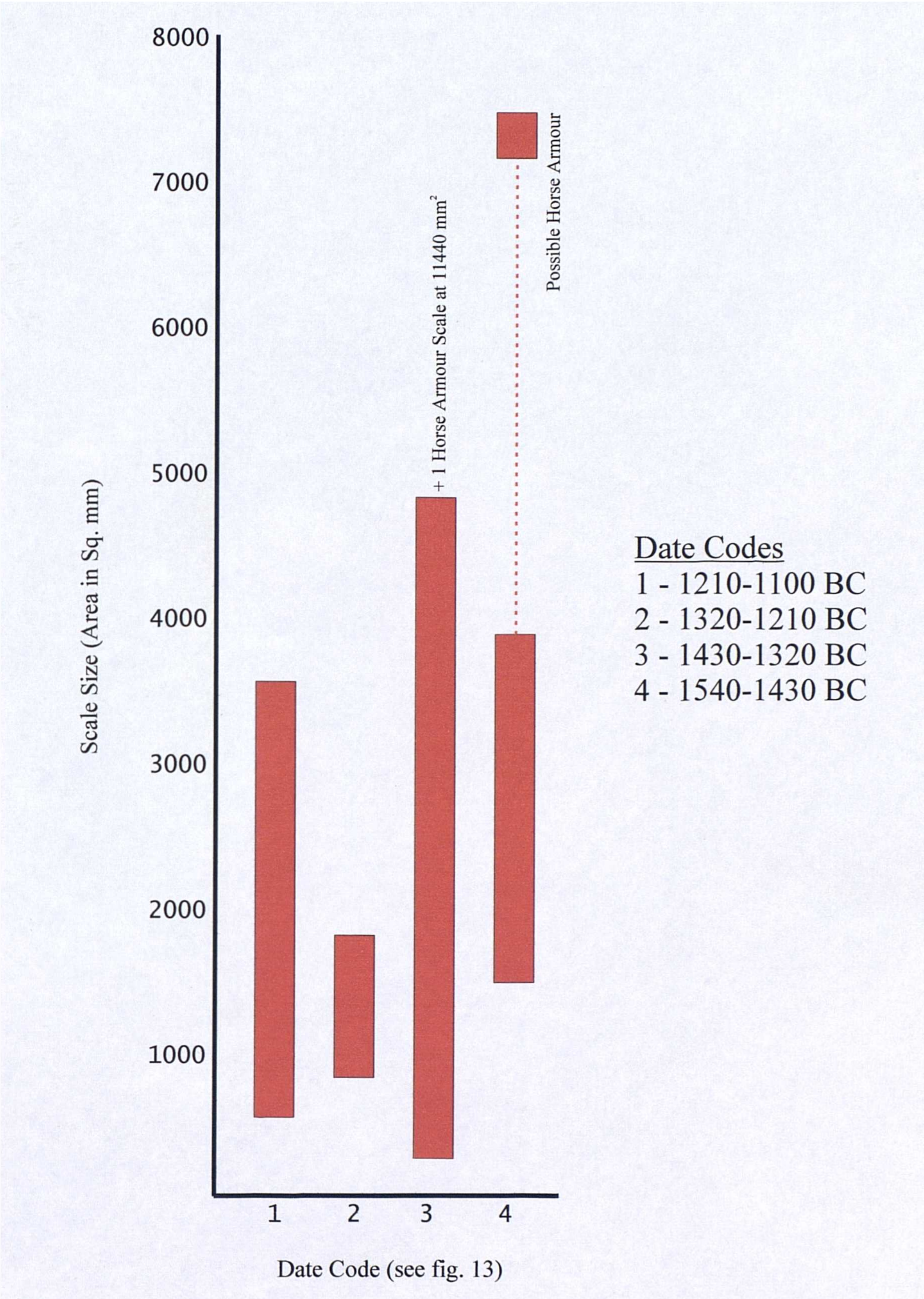
Archaeological Sites vs. the Size of the armour scales in square millimetres



Length-to-Width Ratio of the armour scales for each Archaeological Context

Fig. 76

Fig. 77



Date Code vs. Size of the armour scales in square millimetres

Fig. 78

Lacing Pattern

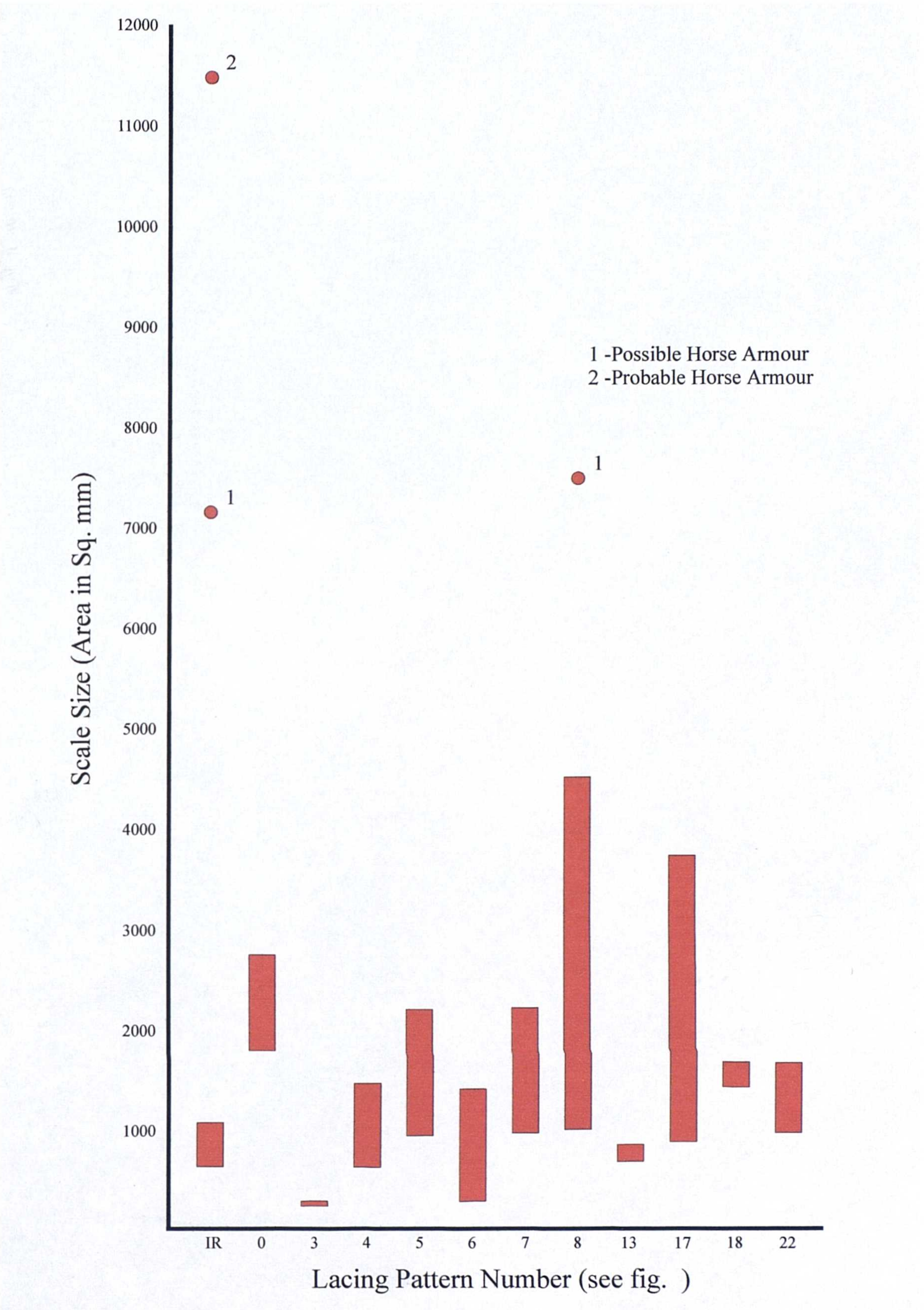
Sites	BR	IR	U	0	3	4	5	6	7	8	10	11	13	14	15	16	17	18	19	21	22
Alalahk																		2			
Beth Shan	4									1											
Bogazkoy	15		37						1								1	6	1		37
Enkomi										2											
Gastria-Alaas										3											
Gezer			1																		
Kamid el-Loz						38	141	1				2									
Lisht										1								1			
Malqata	1									9											
Megiddo	3		2												1	1					
Mycenae										1											
Nuzi	7	1	1	27					2	41				1			1				
Pi-Ramesse	4	3						1												1	
Tel el-'Ajjul		5																			
Tell al-Fakhar									2												
Tell Deir'Alla		16																			
Tell el Fara'h South															1						
Troy	2	1																			
Tut'Ankhamun					4		1	5	1		1		2								
Ugarit	1		49						1	5											
Total Scales Each Lacing Pattern	37	26	90	27	4	38	142	7	7	63	1	2	2	1	2	1	2	9	1	1	37

- Indicates an armour scale of this lacing pattern ***is*** present in the given site

- Indicates an armour scale of this lacing pattern ***is not*** present in the given site

Lacing Pattern compared against the Archaeological Sites

Fig. 79



Lacing Pattern compared against scale Size in square millimetres

Fig. 80

DateCode	BR	IR	U	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
5																											1650 - 1540 BC
4	7	3	1	27 ?							4	41						1	1		1						1540 - 1430 BC
3	10	4	51				4	38	142	6	2	12		1	2		3				1	2	1			1	1430 - 1320 BC
2	4	3	31							1		3										1			1		1320 - 1210 BC
1	16	16	7								1	7								1		6				36	1210 - 1100 BC

Lacing Pattern

Date Code compared with the Lacing Patterns

Fig. 81

Sites	Burial	Domestic Unit	Public Building	Temple Sanctuary	Rubbish Deposit	Courtyard	Workshop	Unknown
Alalakh		2						
Beth Shan		1		2		1		2
Bogazkoy			59	37				2
Enkomi		2						
Gastria-Alaas	3							
Gezer	1							
Kamid el-Loz	182							
Lisht								2
Malqata			10					
Megiddo		6	4					
Mycenae			1					
Nuzi		70						11
Pi-Ramesse							9	
Tel el-'Ajjul								5
Tell al-Fakhar			2					
Tell Deir' Alla				16				
Tell el-Fara'h South	1							
Troy								3
Tut'Ankhamun	14							
Ugarit		2	10			46		
Total in Each Context	**201**	**83**	**86**	**55**	**0**	**47**	**9**	**25**

Context Type compared with the Archaeological Sites

Fig. 82

Contexts

Date Code	Burial	Domestic Unit	Public Building	Temple Sanctuary	Rubbish Deposit	Courtyard	Workshop	Unknown	
5									1650 - 1540 BC
4		70	3					13	1540 - 1430 BC
3	197	2	16	8		47		12	1430 - 1320 BC
2	3	1		31			9		1320 - 1210 BC
1	1	10	67	16					1210 - 1100 BC
	201	83	86	55	0	47	9	25	*Total Scales in Each Context*

Indicates that armour scales ***have*** been found in this context for the given Date Code

Indicates that armour scales ***have not*** been found in this context for the given Date Code

Archaeological Contexts compared with the Date Codes

Fig. 83

Context	BR	IR	U	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Number of Scales in Each Context
Burial			1				4	38	142	1	1	3		1	2		2		1								201
Domestic Unit	7	1	2	24							2	42						1		1	1	2					83
Public Building	17		10								3	13							1			6				36	86
Temple Sanctuary	4	16	31								1										1		1			1	55
Rubbish Deposit																											0
Courtyard	1		46																								47
Workshop	4	3								1															1		9
Unknown	8	6	2	3								5										1					25

Lacing Pattern

Archaeological Contexts compared with all of the possible Lacing Patterns

Sites	Arrowheads	Other Weaponry	Gold	Silver	Alabaster	Ivory	Faience	Figurines	Weights	Seals	Scarabs
Alalakh	1										
Beth Shan			25	several	4	2	39+	4	2	19	9
Bogazkoy	numerous		numerous			1		1	unknown	2	
Enkomi											
Gastria-Alaas											
Gezer	2	1		1							
Kamid el-Loz	28	1	118			1 ?					
Lisht		6									
Malqata											
Megiddo		1			1		5	1	1		
Mycenae											
Nuzi	28	10						4	1		
Pi-Ramesse	numerous	numerous									
Tel el-'Ajjul											
Tell al-Fakhar	numerous	numerous									
Tell Deir' Alla	2	1	1		2 or 3		3 or 5		1	5	
Tell el-Fara'h South			1					2			5
Troy			1 (electrum)	1 (electrum)		1				1	
Ugarit	19	4	2 +frags.	1	5 +frags.	6	4	4	14	5	1 ?
Tut'Ankhamun											

Indicates that armour ***has*** been found in association with the given artefact type at the given site.

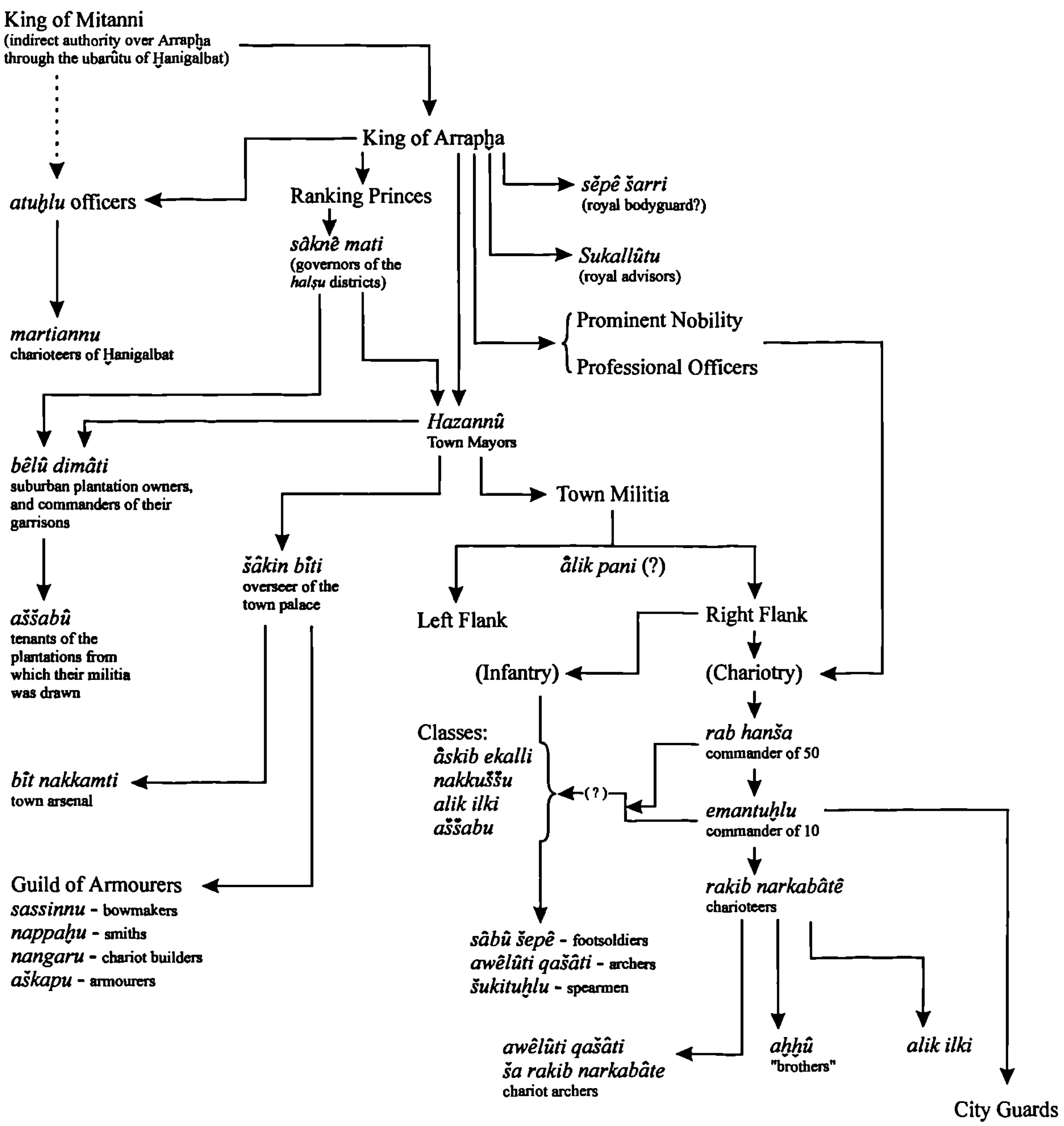
Indicates that armour ***has not*** been found in association with the given artefact type at the given site.

Numerous artefacts of each of these categories were found in the tomb of Tut'Ankhamun.

Sites compared with other artefact types associated with scale armour

Fig. 84

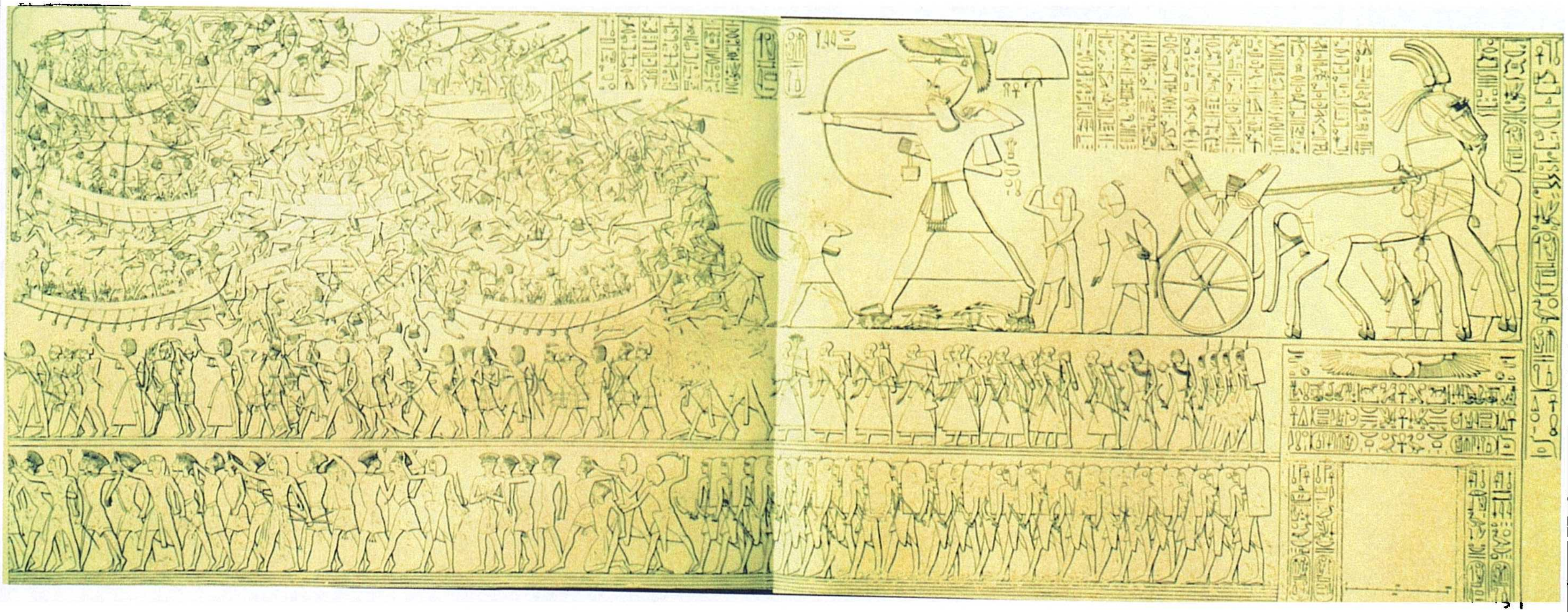
Fig. 85



Suggested Reconstruction of Arrapḫa's Military Organization

Adapted from: Kendall 1974: 75

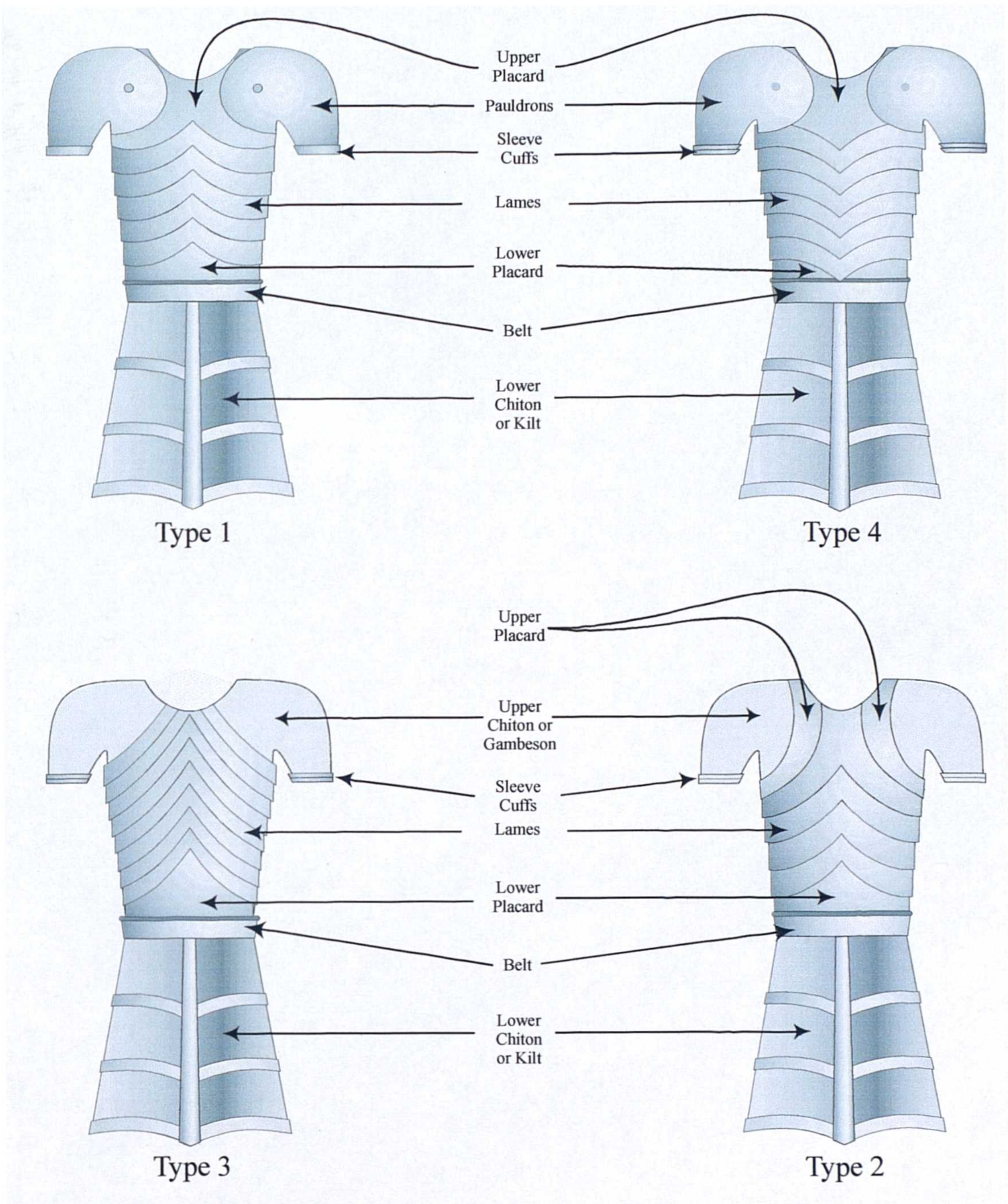
Fig. 86



The Naval Battle from the temple at Medinet Habu, depicting Ramses III in battle against the Sea Peoples

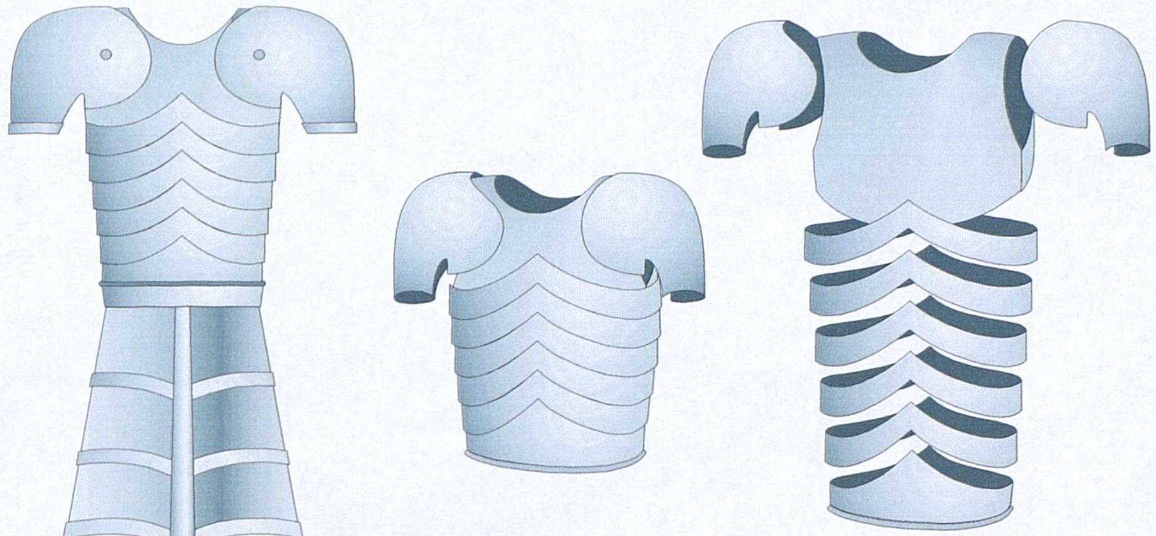
Adapted from: Breasted 1930: Pl. 39

Fig. 87



"Parts Inventory"of the four types of Sea Peoples armour

Fig. 88



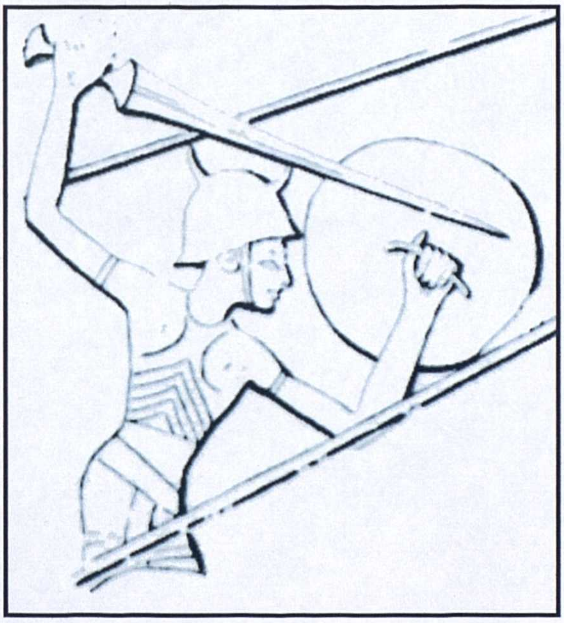
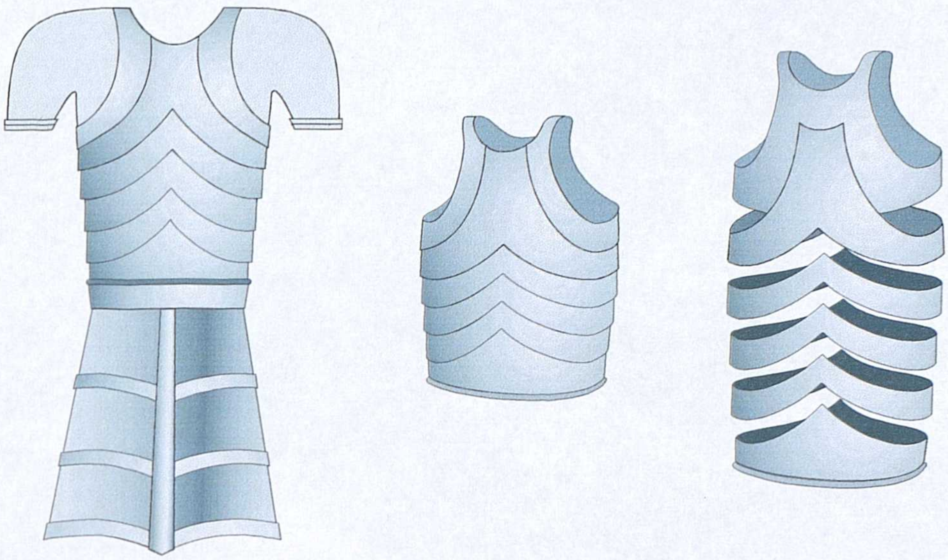


Image adapted from Plate 39, Medinet Habu Series, Vol. 1, University of Chicago Oriental Institute Publications, 1930.

Shardana soldier wearing Armour Type 1

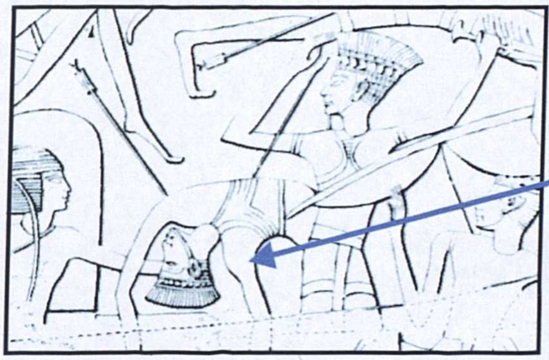
Sea Peoples Type 1 armour



Two-Dimensional View

Three-Dimensional View

Exploded Three-Dimensional View



Dead Sea Peoples soldier wearing Armour Type 2.

Sea Peoples' soldier wearing Armour Type 2

Images adapted from Plate 39, Medinet Habu Series, Vol.1 University of Chicago Oriental Institute Publications, 1930.

Sea Peoples Type 2 armour

Fig. 90

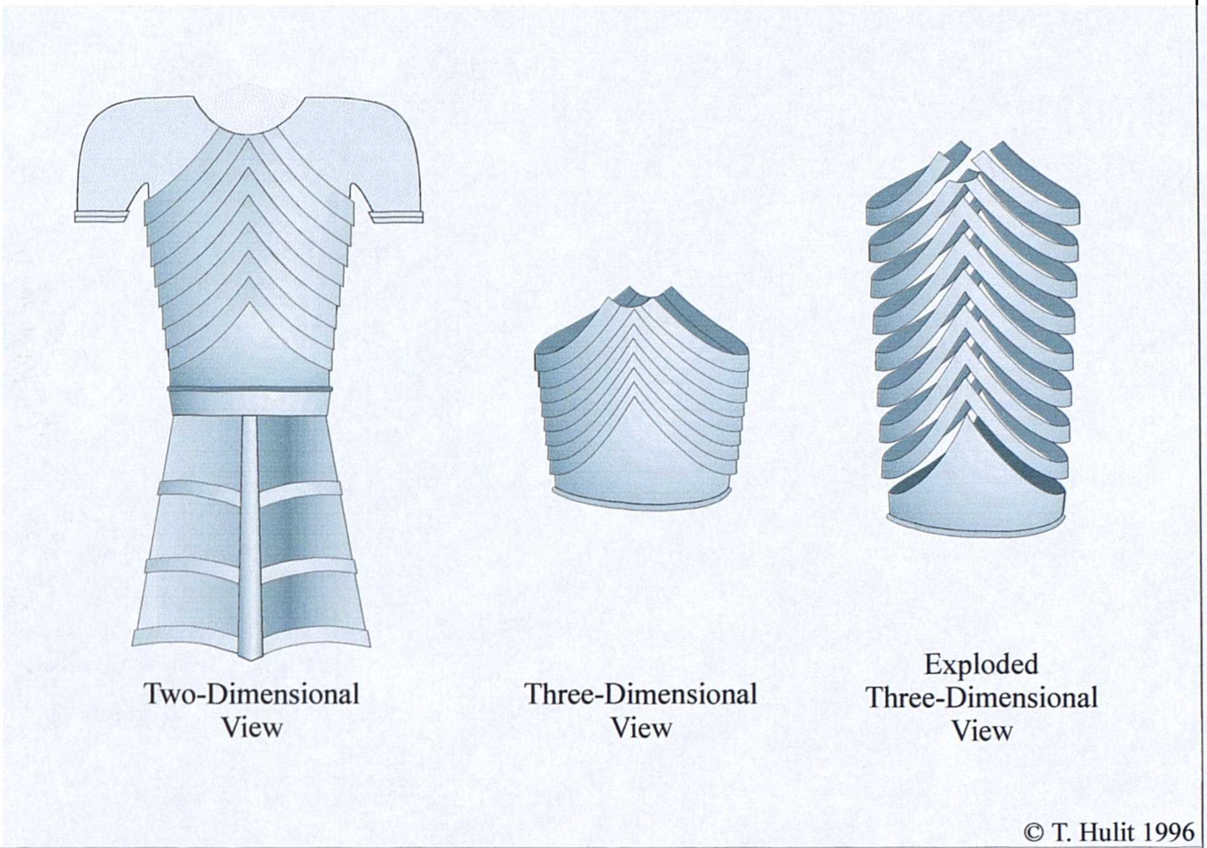
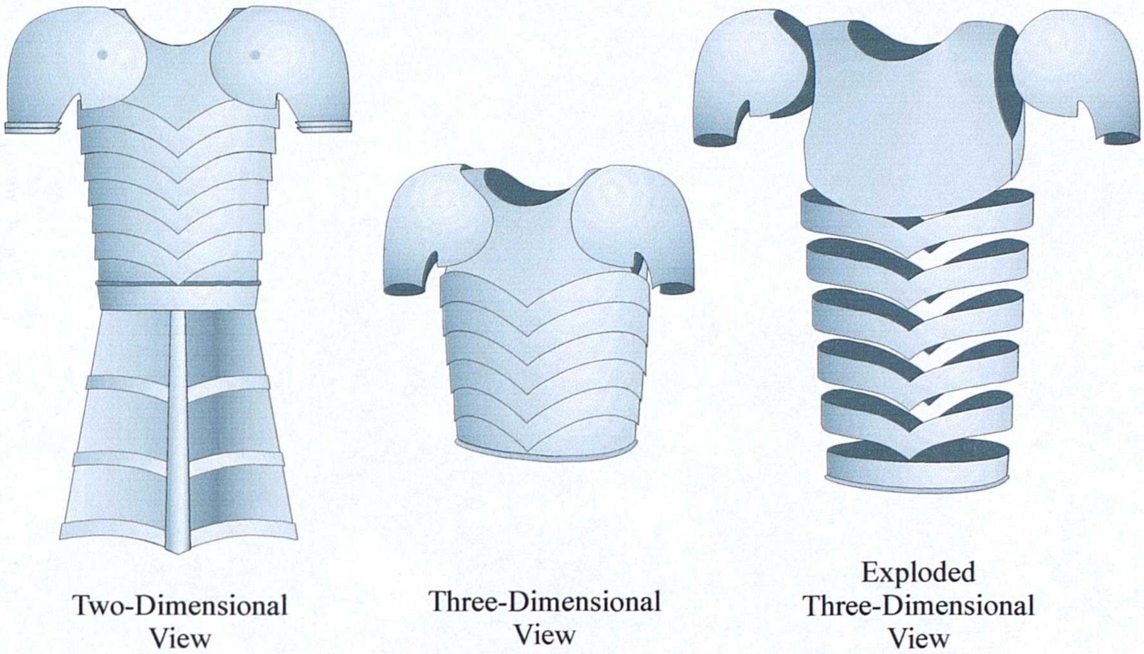


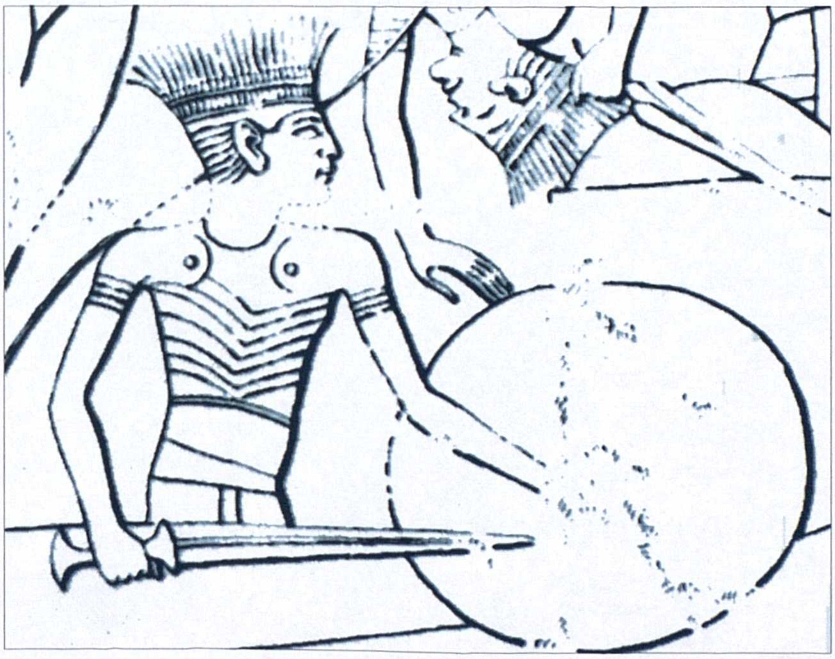
Image adapted from Plate 39, Medinet Habu Series, Volume 1, University of Chicago Oriental Institute Publications, 1930.

Dead Sea Peoples soldier wearing Armour Type 3.

Sea Peoples Type 3 armour

Fig. 91



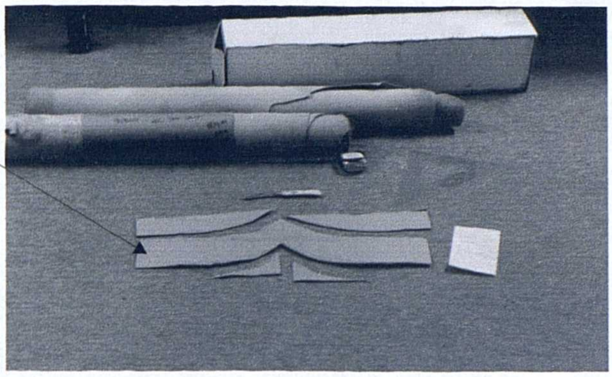


Sea Peoples soldier wearing Armour Type 4

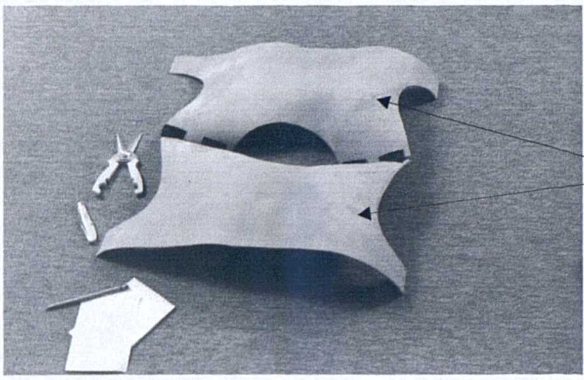
Image adapted from Plate 39, Medinet Habu Plate Series, University of Chicago Oriental Institute Publications, 1930.

Sea Peoples Type 4 armour

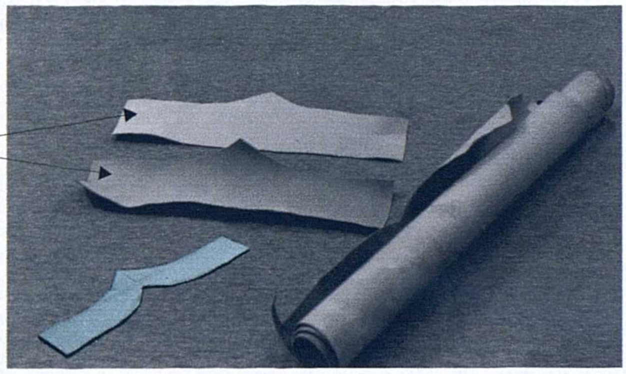
Fig. 92



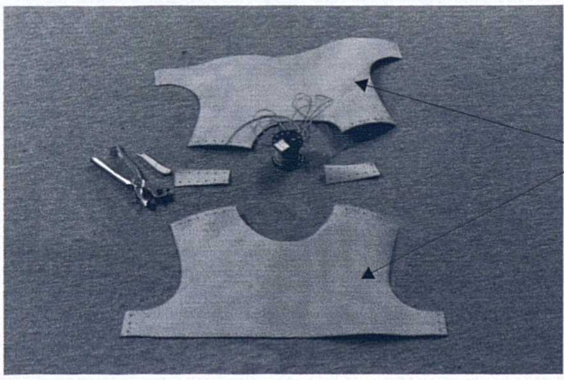
A: Single lame cut from the hide



B: Front and Back Upper Placards cut from the hide



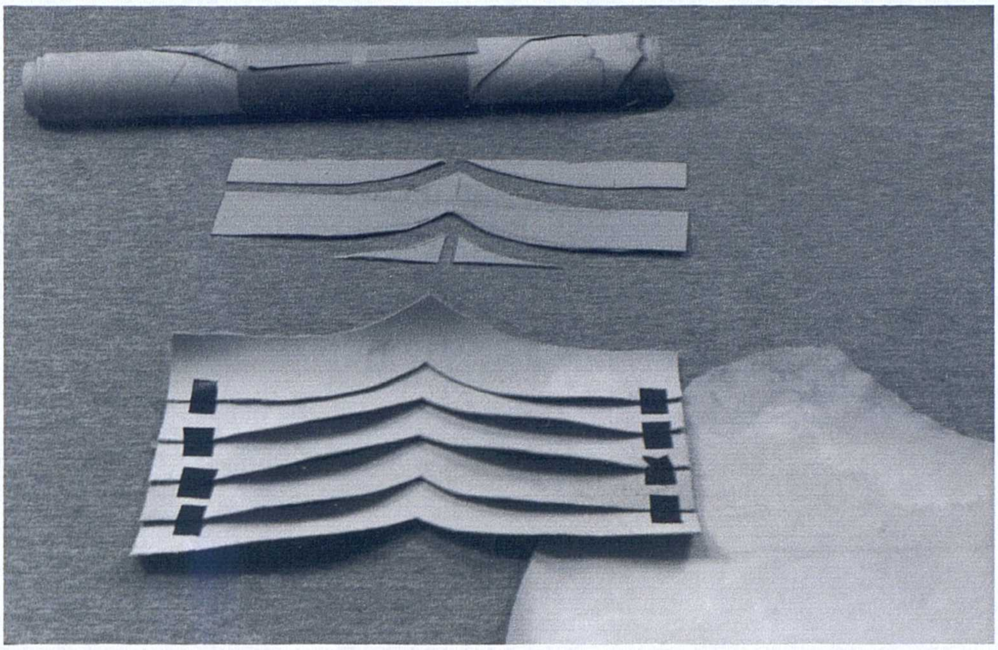
C: Lower hem-lames cut from the hide.



D: Upper front andback placards after punching the lacing holes.

Four stages in the manufacture of the replcia Sea Peoples leather armour

Fig. 93

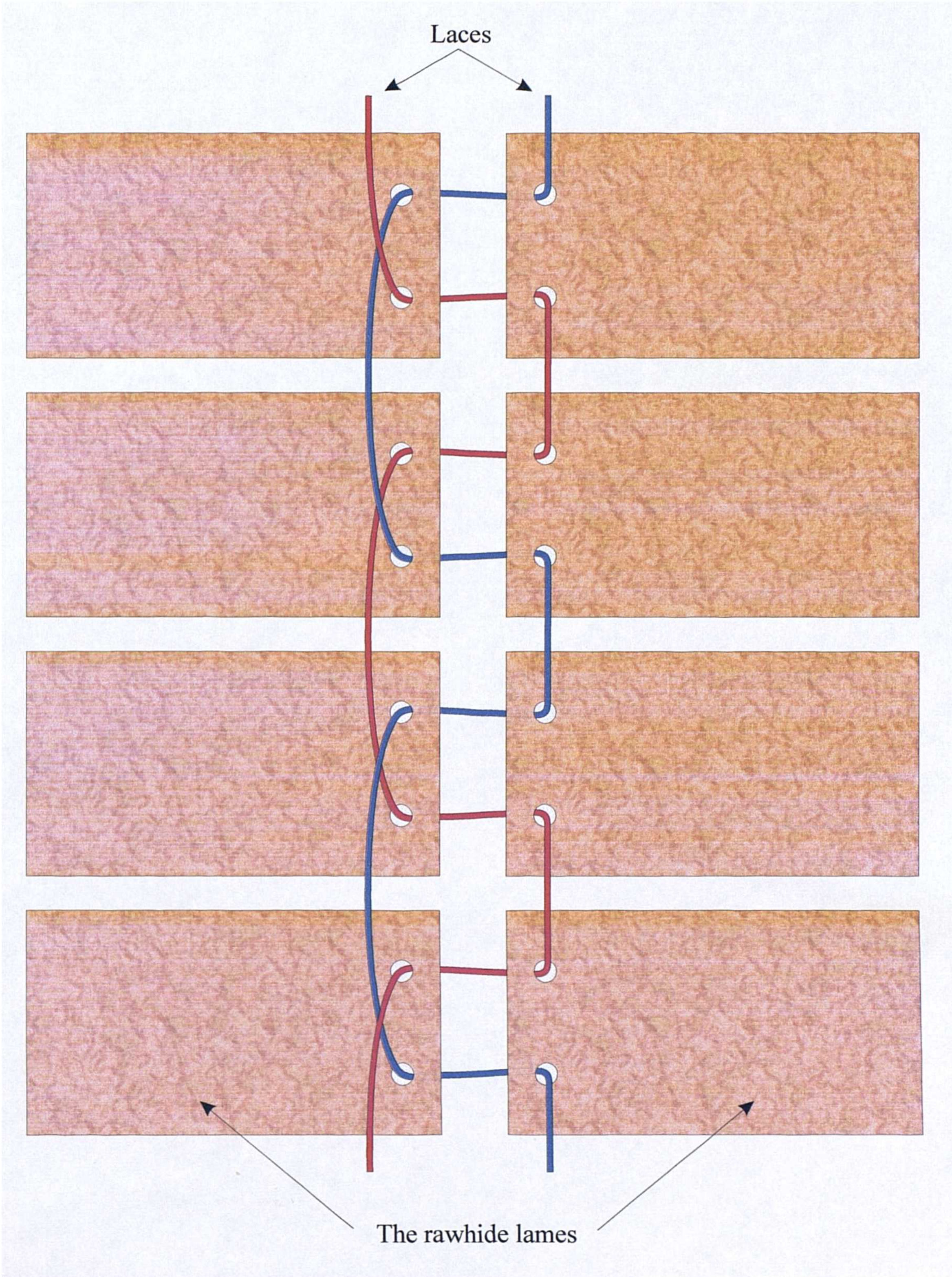


A: Section of un-trimmed lames taped together to determine the initial height of the central section of the armour.

B: The upper front and back placards laced together prior to attaching the lames.

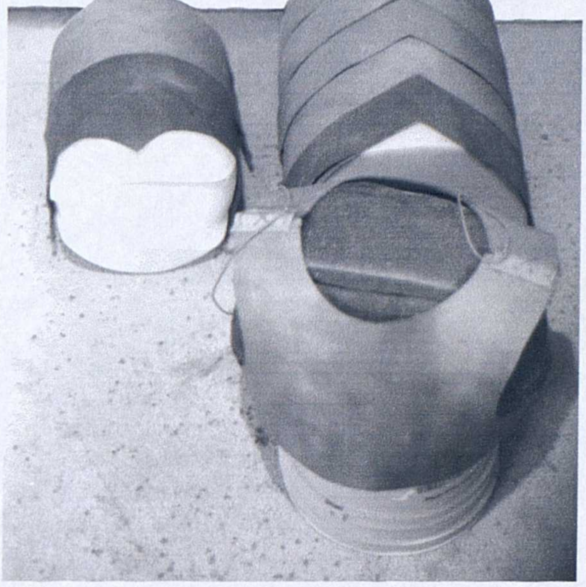
Two stages in assembling the replica Sea Peoples leather armour.

Fig. 94

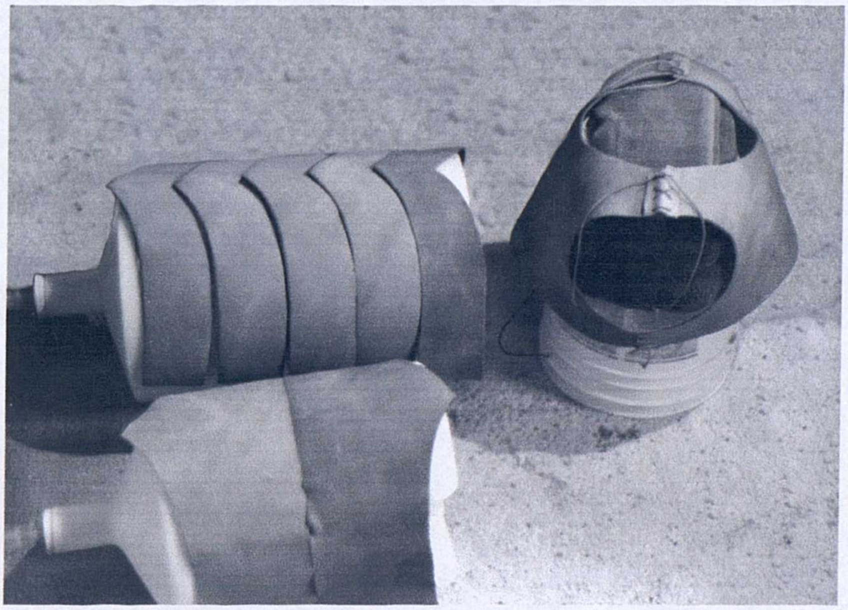


Lacing pattern at the side of the torso, joining the front and back sets of lames of the Sea Peoples style of armour

Fig. 95



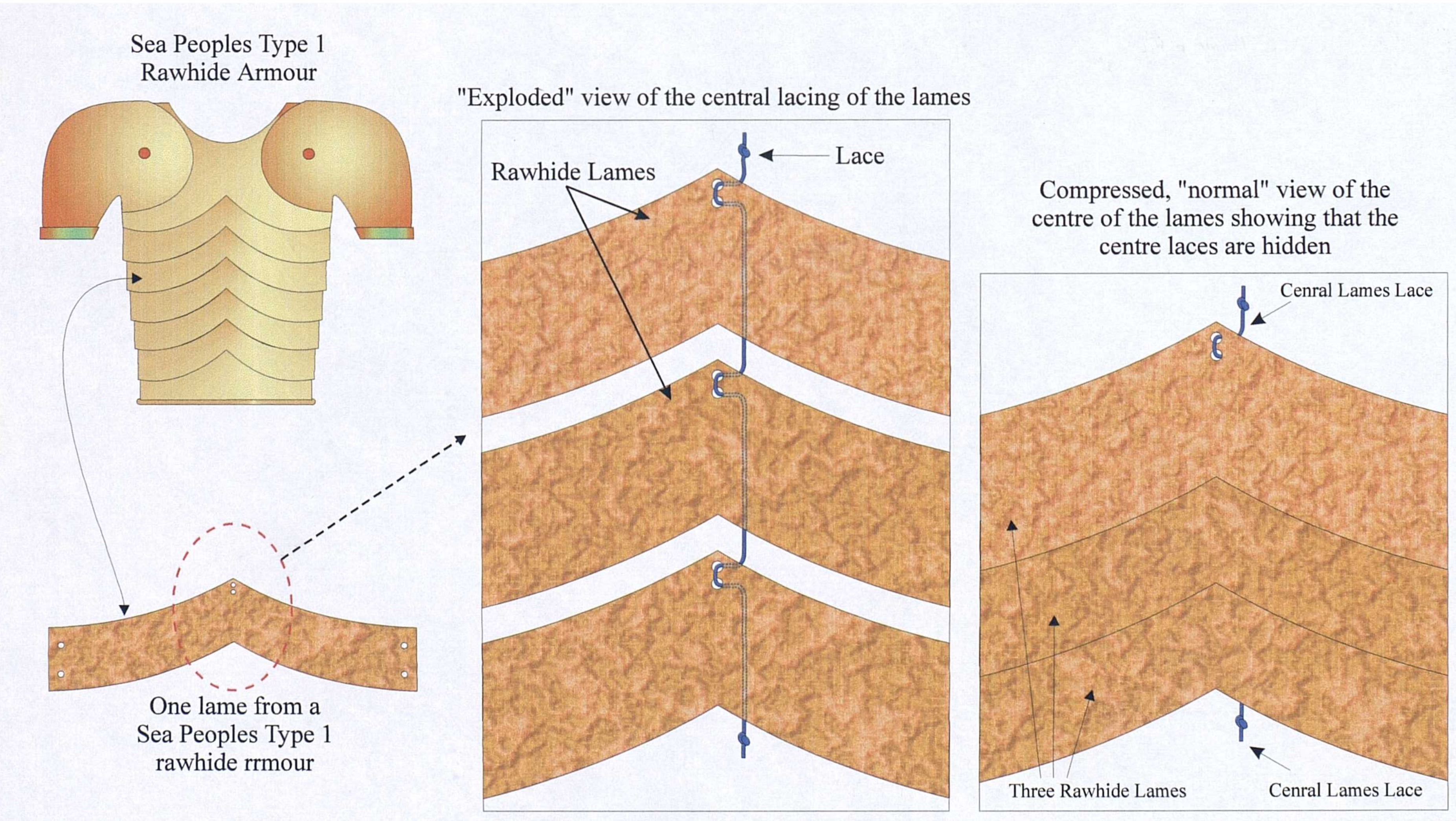
A: Water-hardening the armour on forms



B: Water-hardening the armour on forms

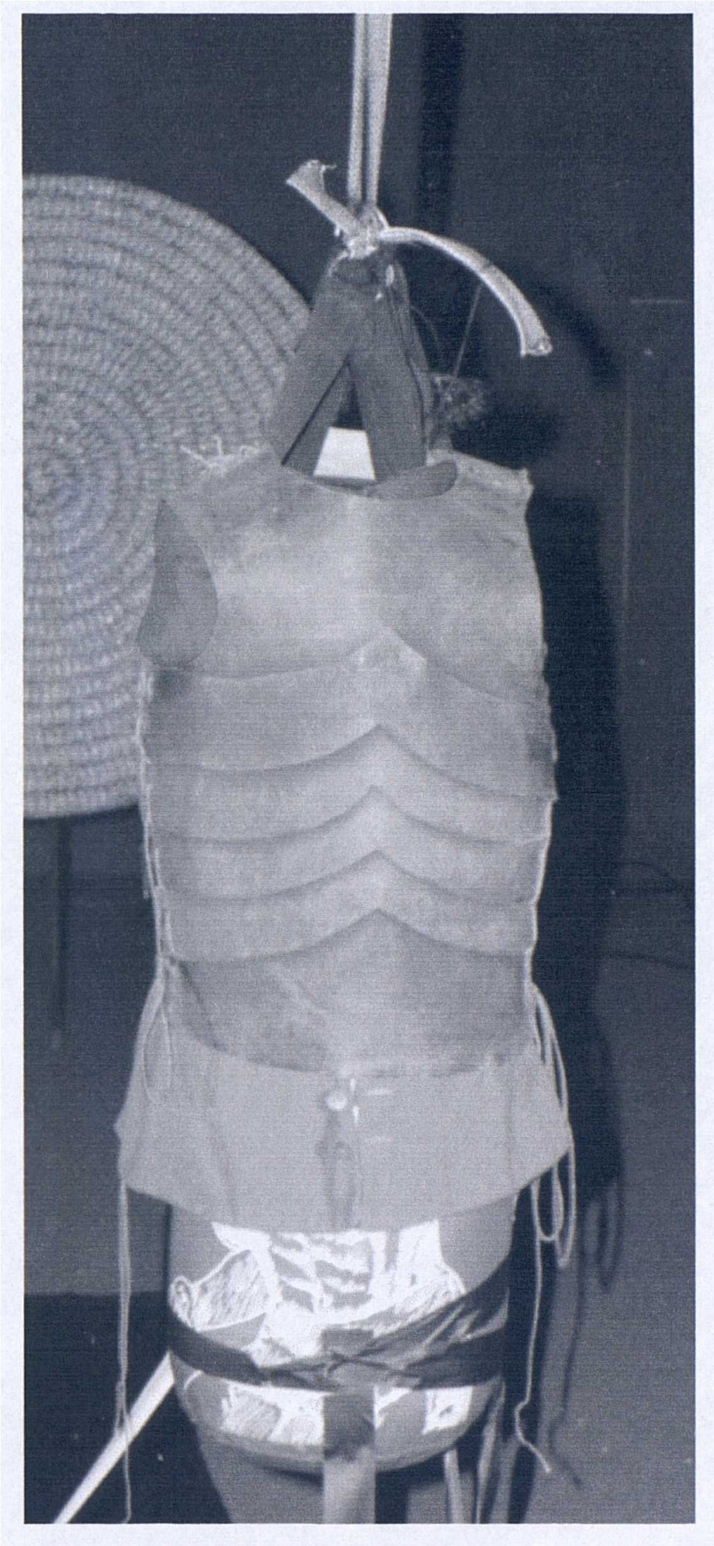
Water-hardening the armour over drying-forms

Fig. 96



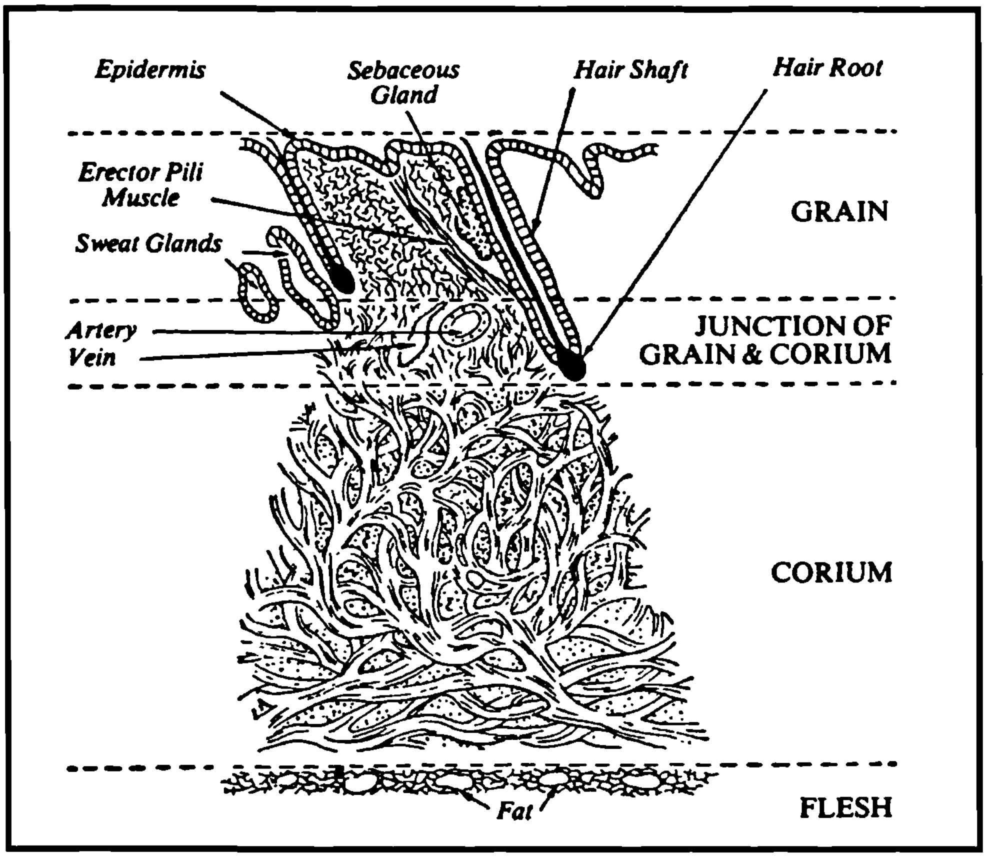
Method of lacing the centre of the lames together on the Sea Peoples style armour

Fig. 97



The replica Sea Peoples waxed-leather armour placed on the martial arts punching bag target.

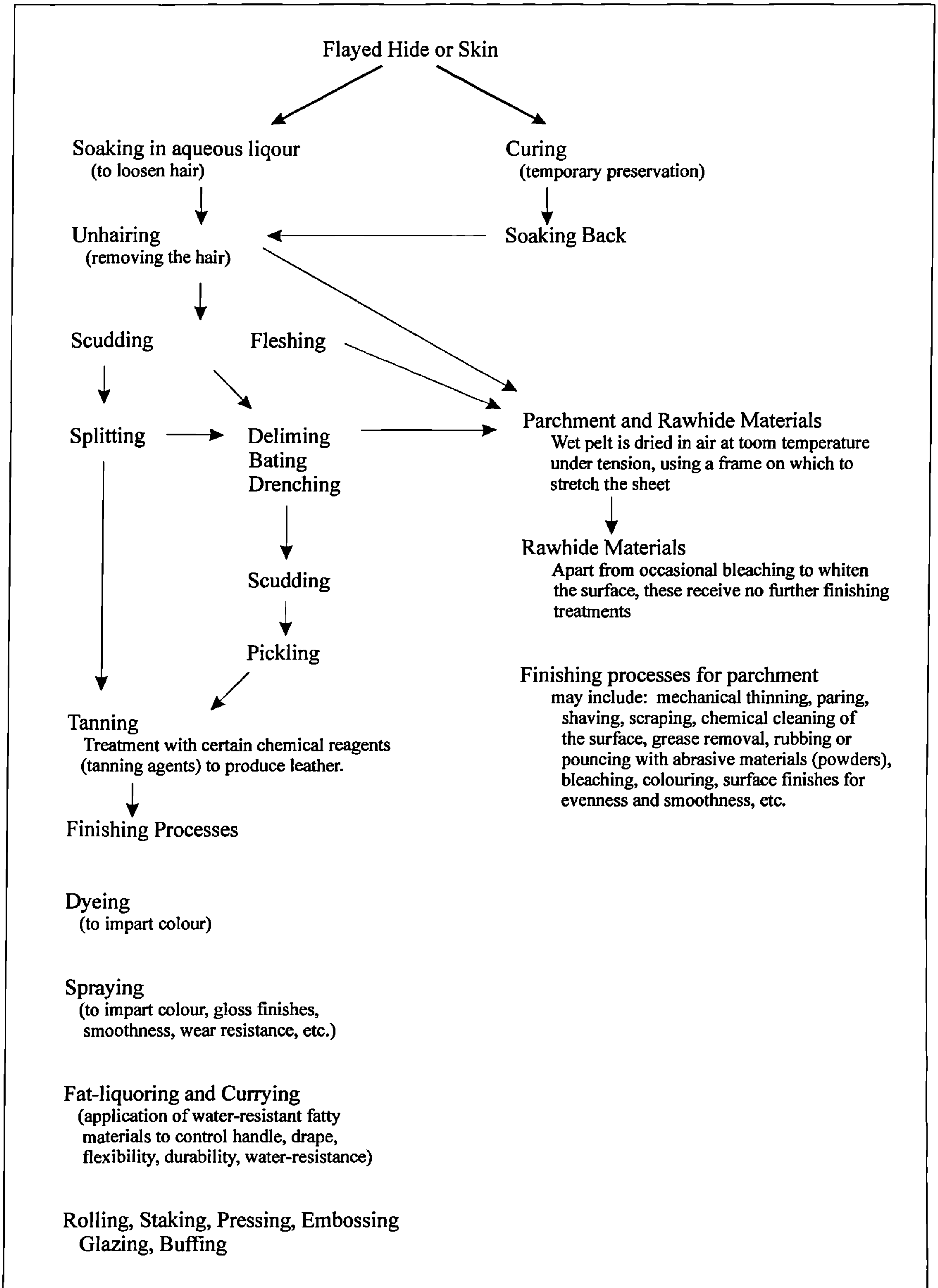
Fig. 98



A cross-section of mammalian skin denoting the structure

From: Sharphouse 1983: 21, fig. 3

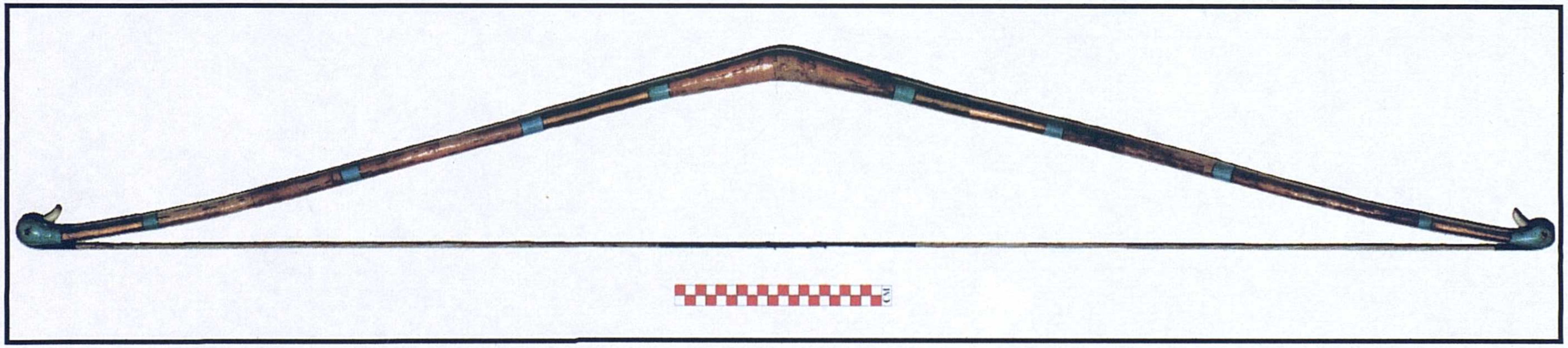
Fig. 99

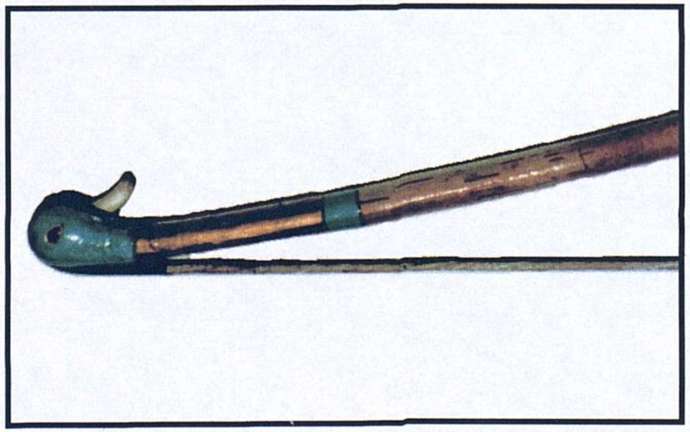


Stages in the Production of Leather or Rawhide

Adapted from: Reed 1972: 47, table 1

Fig. 100

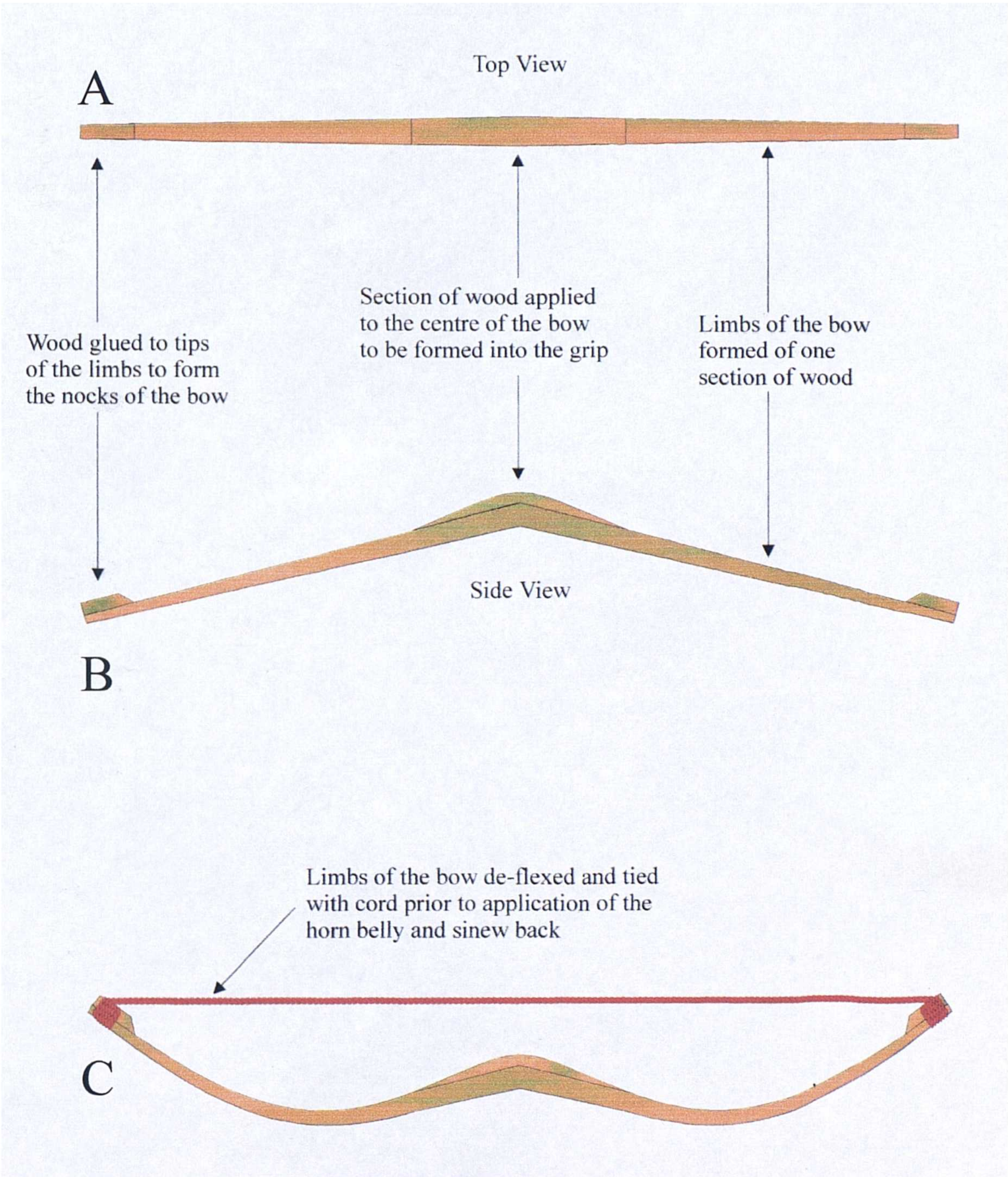




Detail of "duck's head" nock at end of bow limb.
- Note the manner in which the string loops over the end of the limb and secures on the "beak" of the "duck-head"

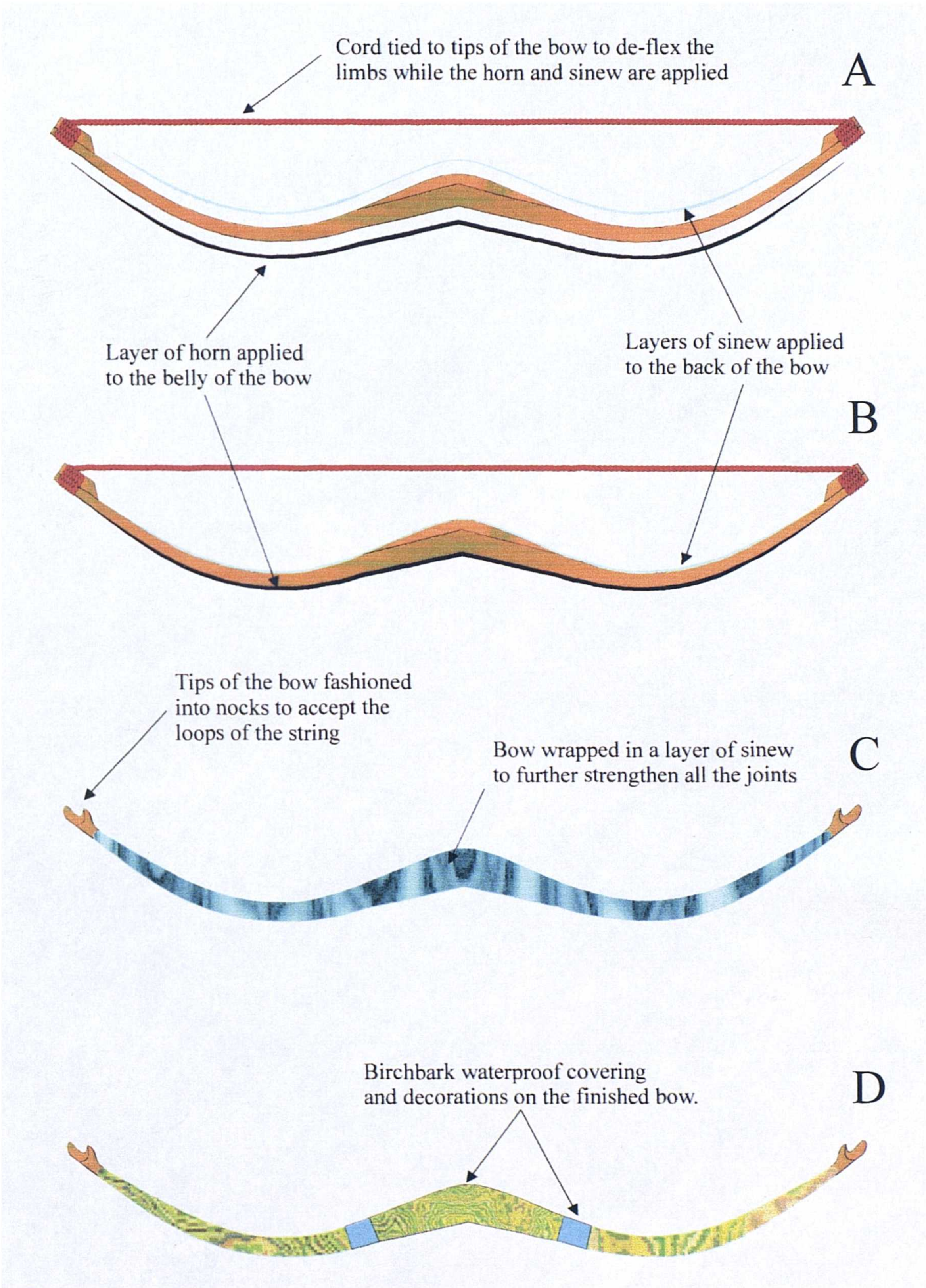
Replica Near Eastern composite bow made by Edward McEwen for the experimental research presented in Chapter 3

Fig. 101



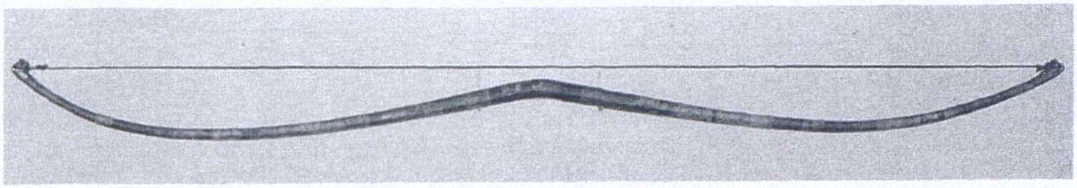
The first three basic stages in the manufacture of the replica Egyptian composite bow.

Fig. 102



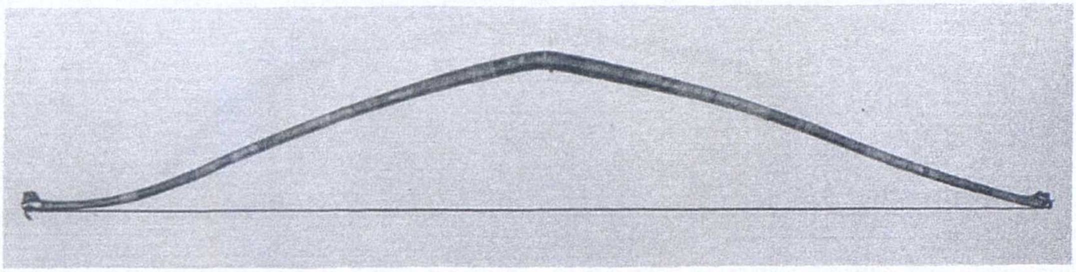
The final four basic stages in the manufacture of the replica Egyptian composite bow.

A



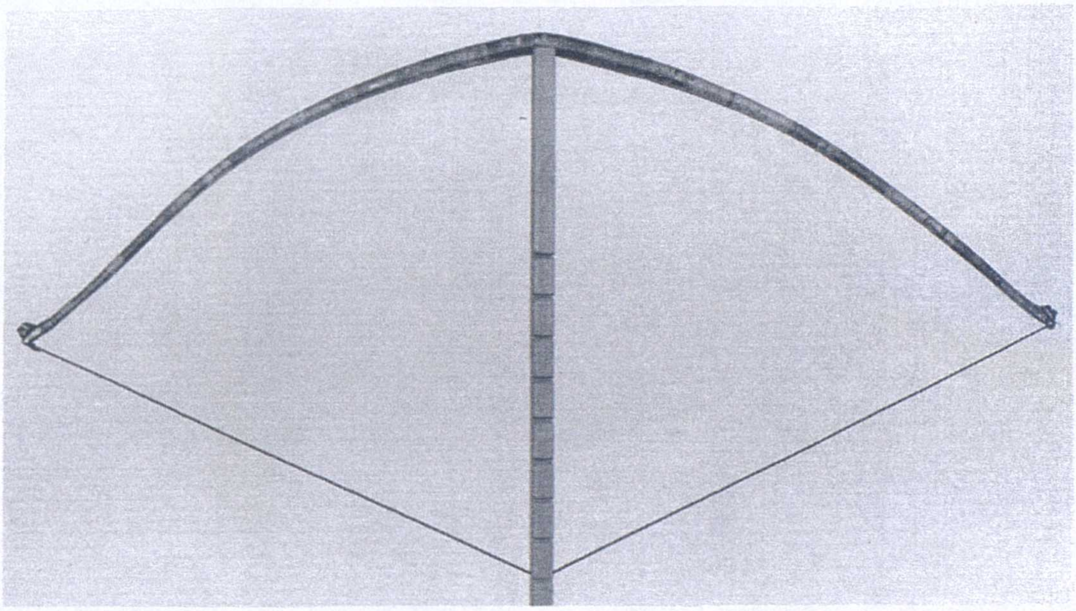
Replica of Egyptian horn composite angular bow by Edward McEwen. Deflexed, recurved, at rest, string on backwards.

B



Bow braced.

C



Same bow at full draw.

Replica Egyptian composite bowunstrung, strung, and drawn (on a tillering brace)

Adapted from: Grayson (1993: 133)

Fig. 104

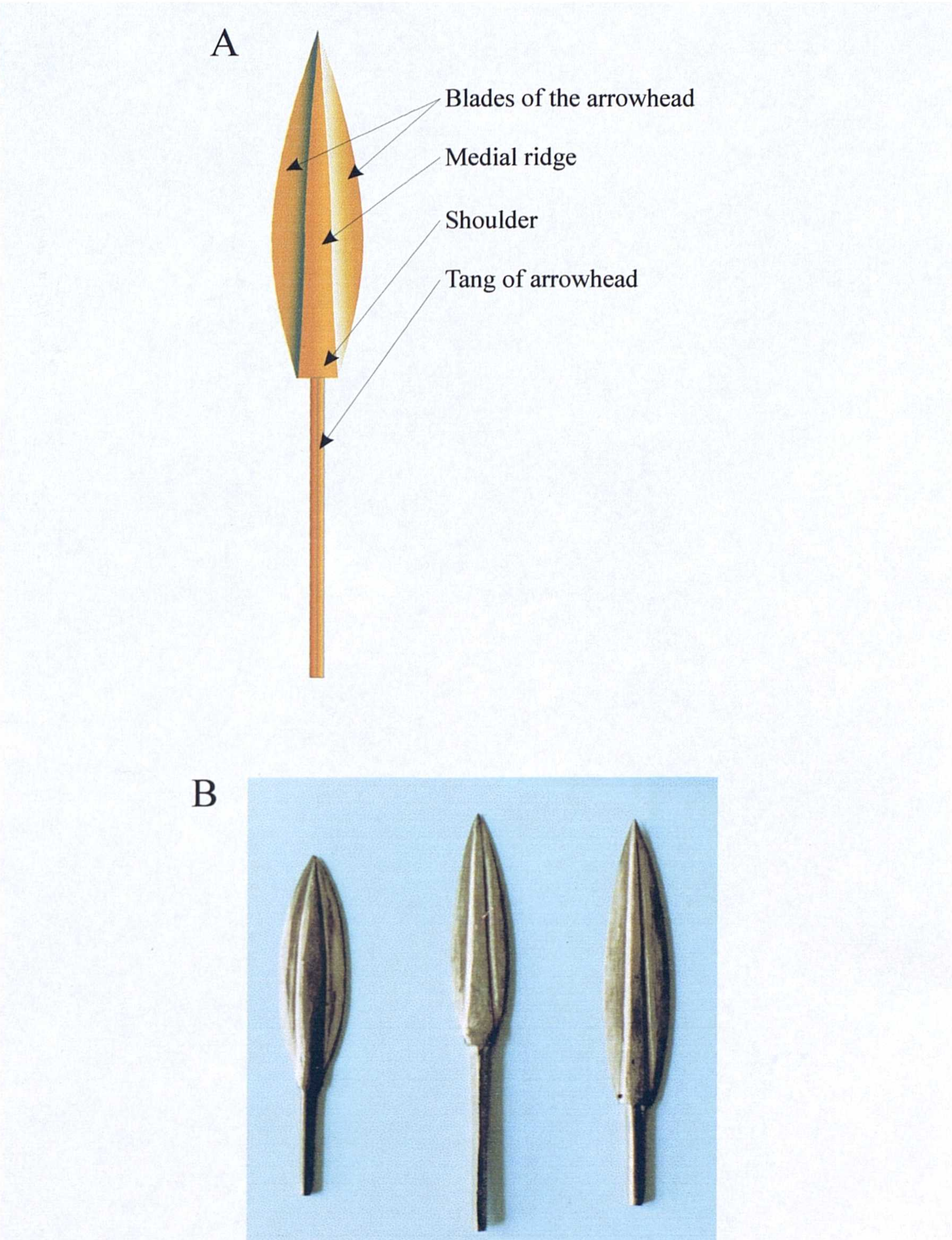
A: McEwen's composite bow in unstrung position.

B: McEwen's composite bow strung and at rest

C: McEwen's composite bow at full draw

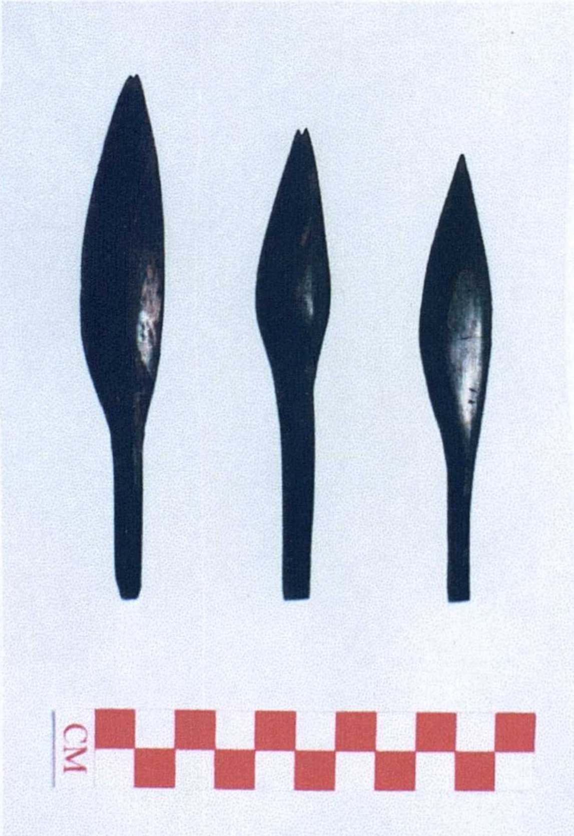
Composite bow (made by E. McEwen) used in the experimental research for Chapter 3
(demonstrated by Andrew Bodley, H.M. Royal Armouries Museum)

Fig. 105

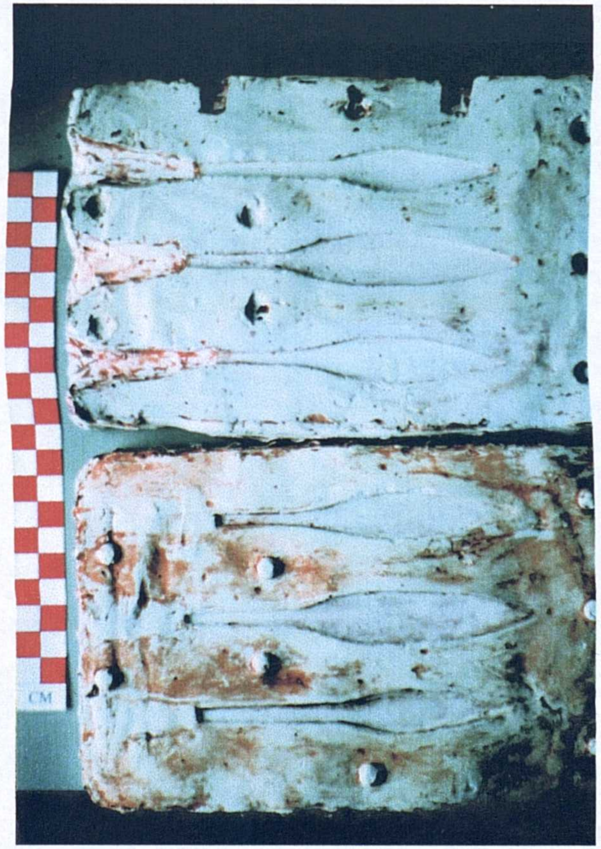


Morphology of Late Bronze Age arrowheads and the three types produced for the experimental work

Fig. 106



A: Three ironwood arrowheads used to make the mould to cast the wax arrowhead blanks

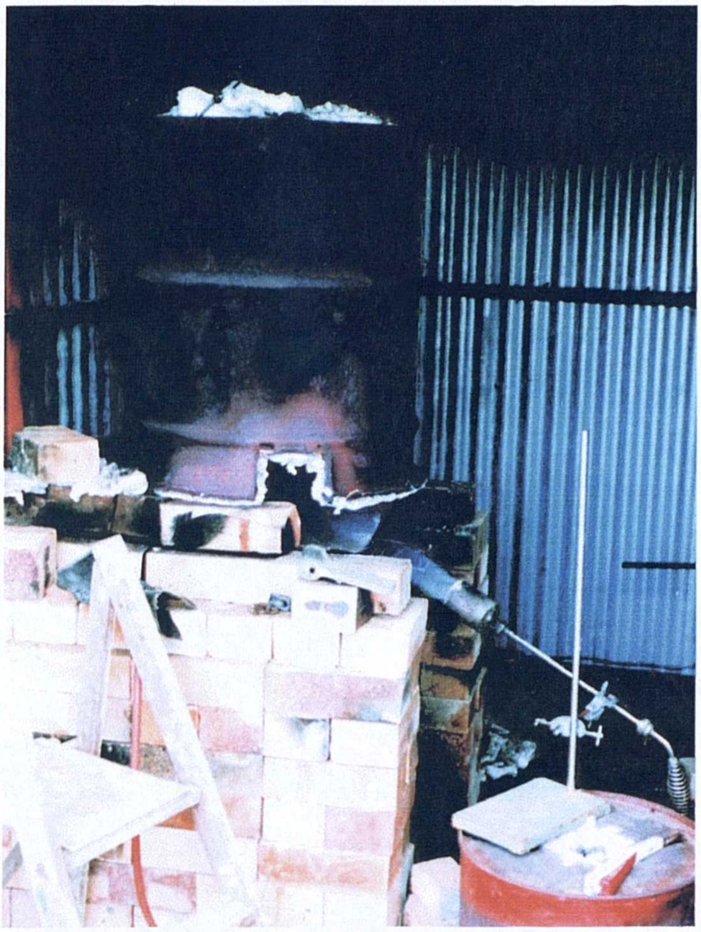


B: Plaster moulds made from the ironwood arrowhead blanks

C: Finished arrowhead moulds made from the wax arrowhead blanks

The ironwood arrowhead blanks, the plaster moulds for making the wax arrowhead blanks, and the finished arrowhead moulds prior to removal of the wax

Fig. 107



A

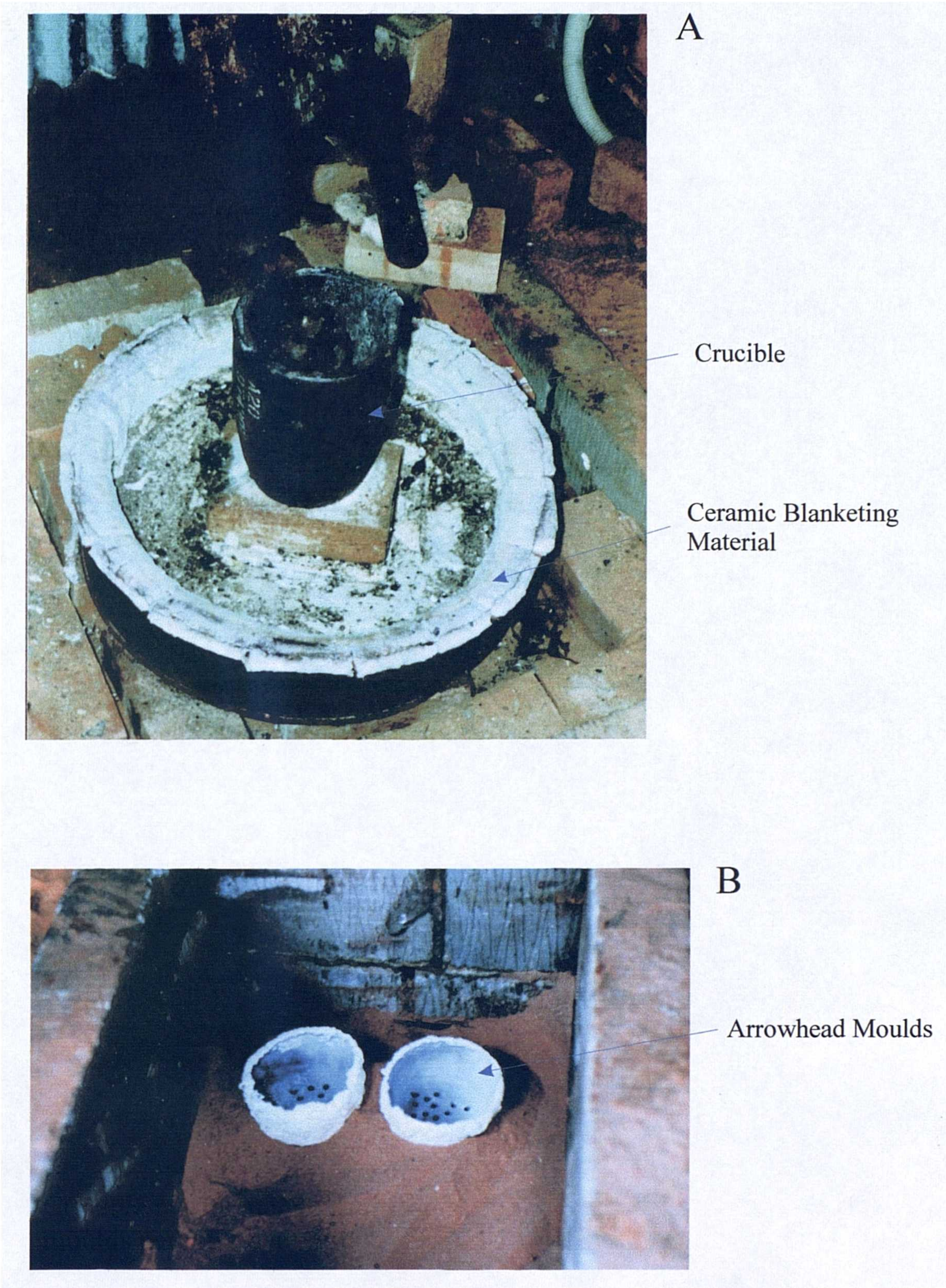
B

Wax-flashing furnace being heated and arrowhead moulds being placed inside the furnace

Fig. 108

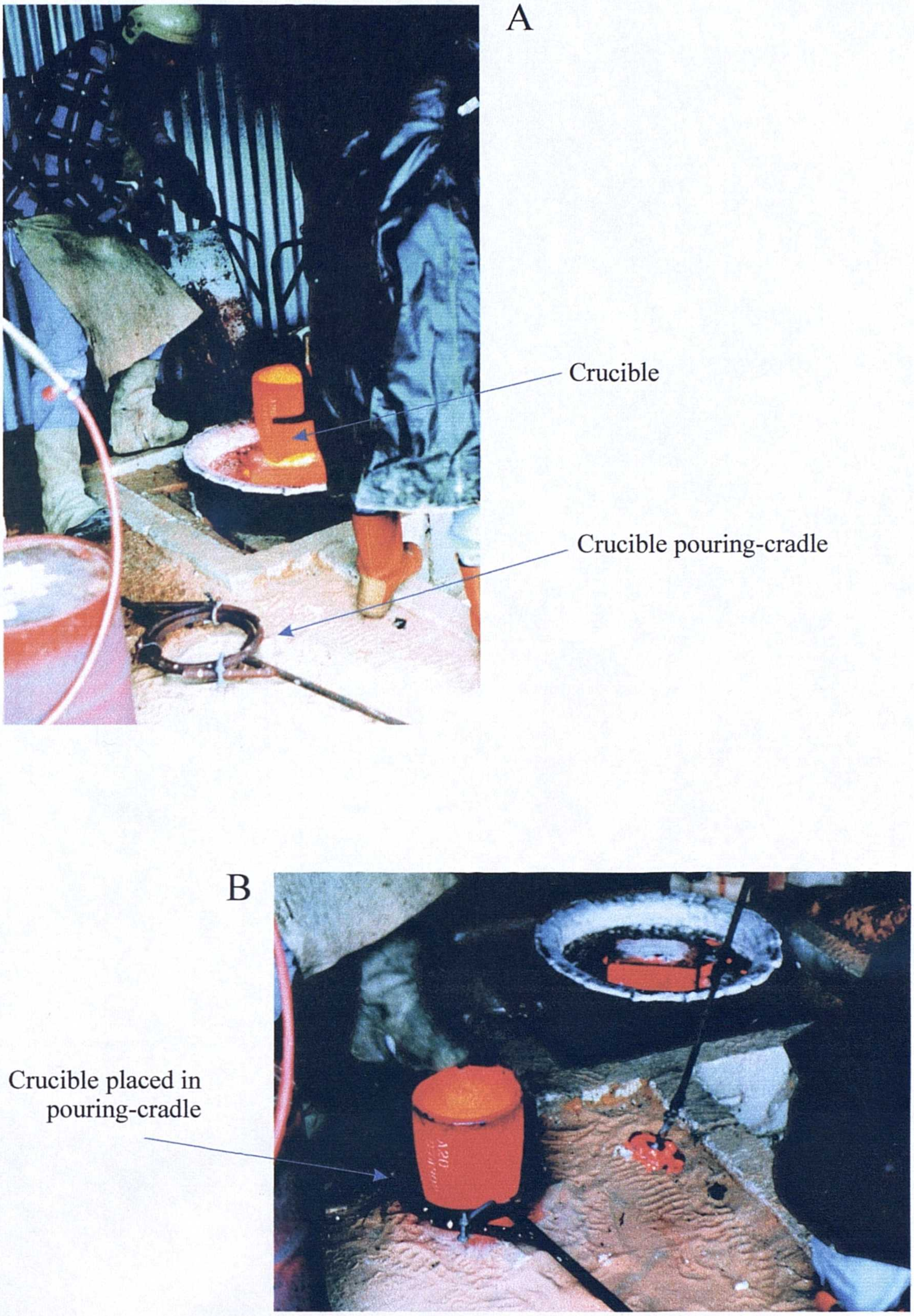
Molten wax burning as it is flashed from the arrowhead moulds

Fig. 109



Crucible placed in the base of the casting furnace and two arrowhead moulds partially buried in the casting pit

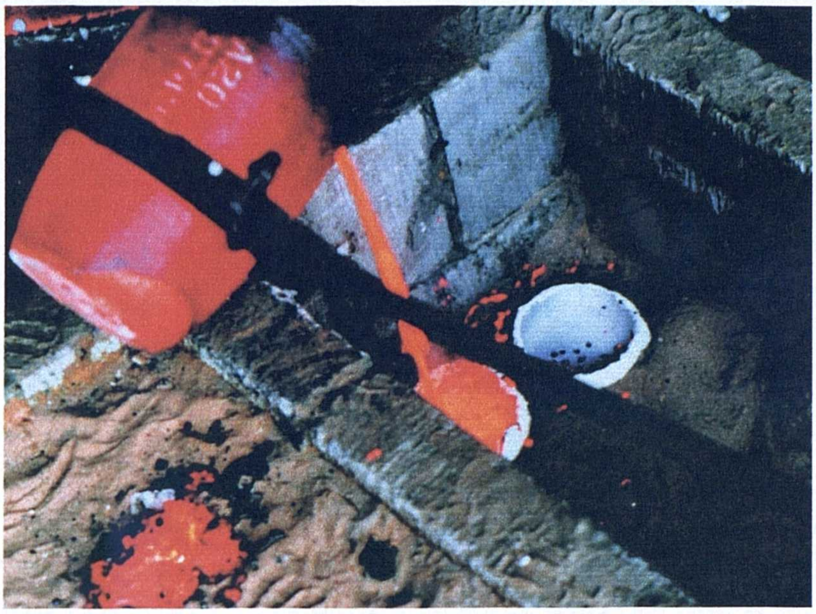
Fig. 110



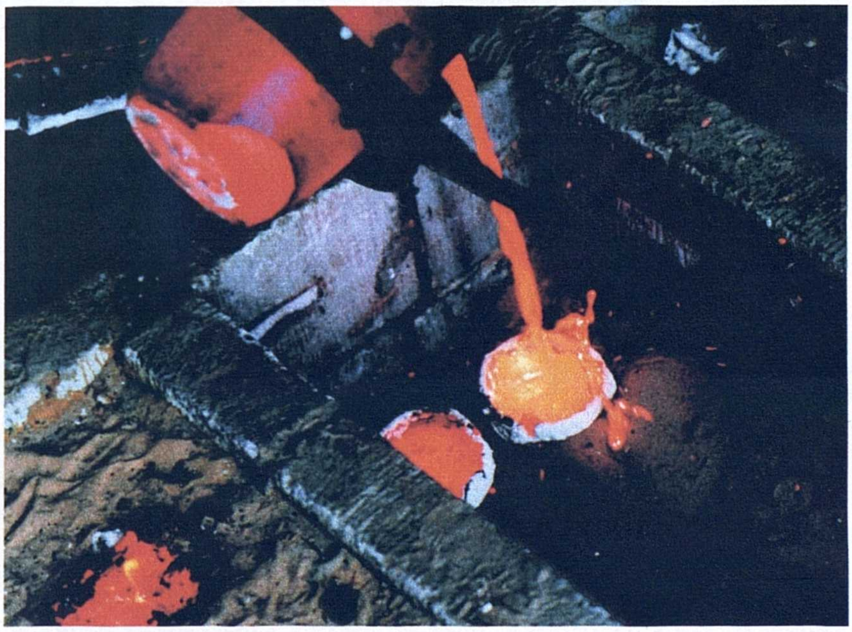
Hot crucible being lifted with tongs and placed into the pouring-cradle

Fig. 111

A

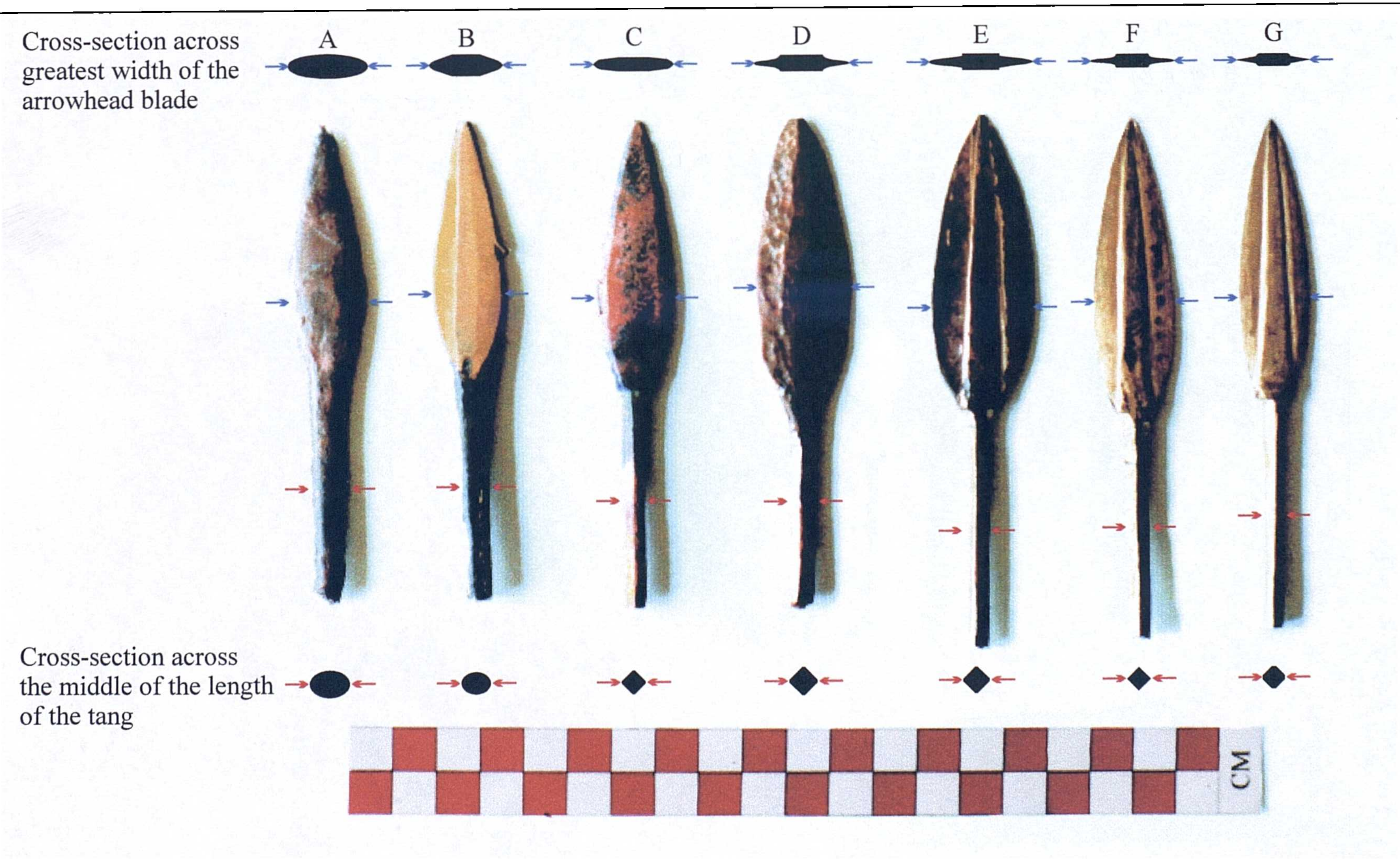


B

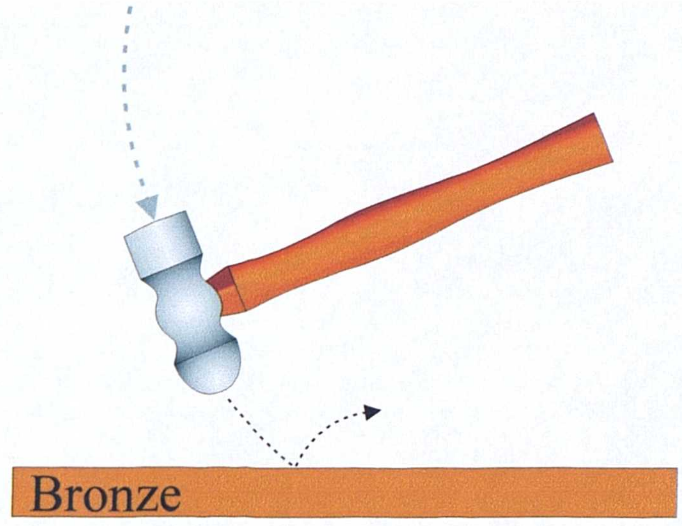


Arrowhead moulds being filled with molten bronze

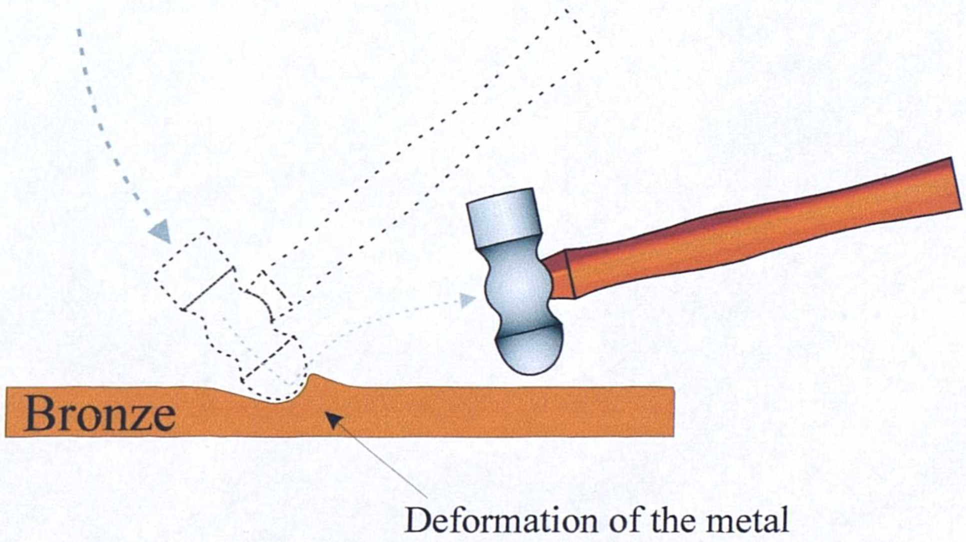
Fig. 112



The seven stages of production of the replica bronze arrowheads



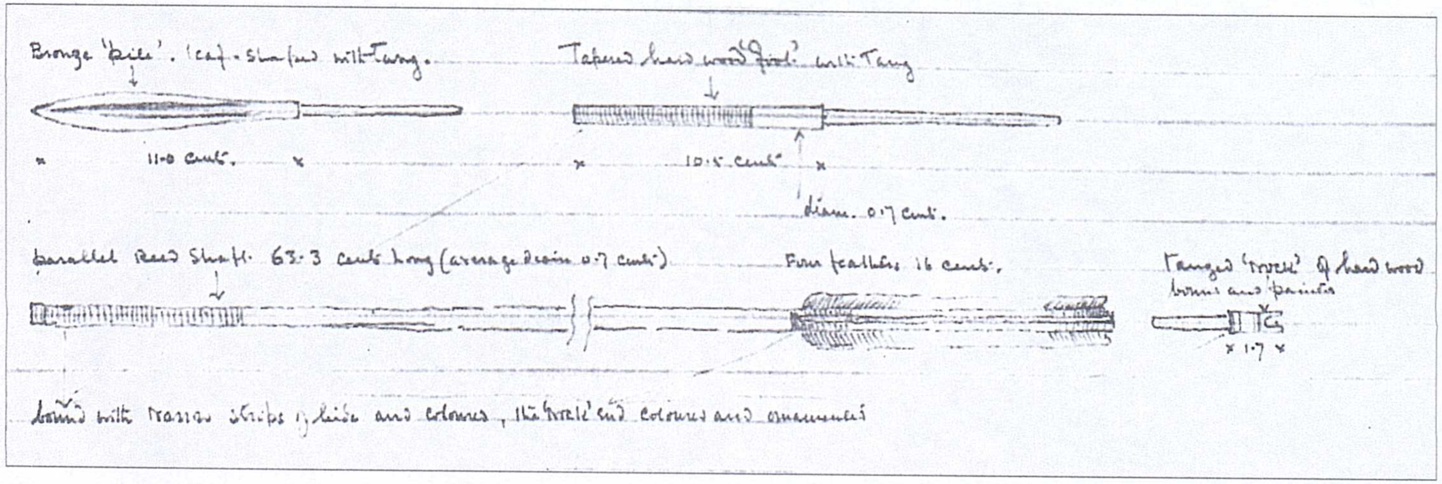
Direction and angle of hammer blow gauged to spread metal in the direction desired, as in lengthening the tang of an arrowhead or spreading the edges of the blades of an arrowhead.



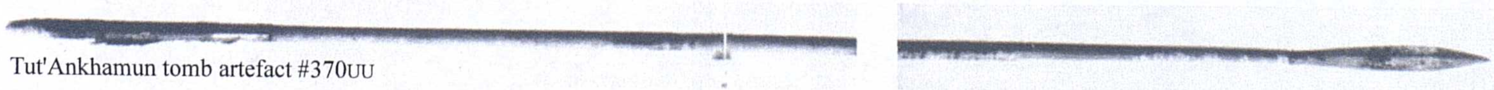
The strike, and subsequent bounce, of the hammer and the shape of the resulting deformation of the metal.

Deformation of the metal when struck during cold working

A

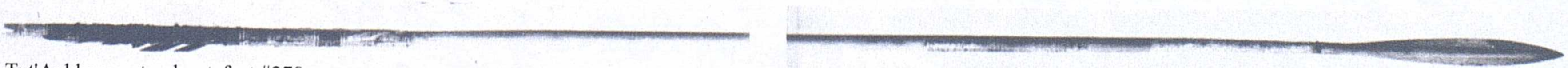


B



Tut'Ankhamun tomb artefact #370UU

C



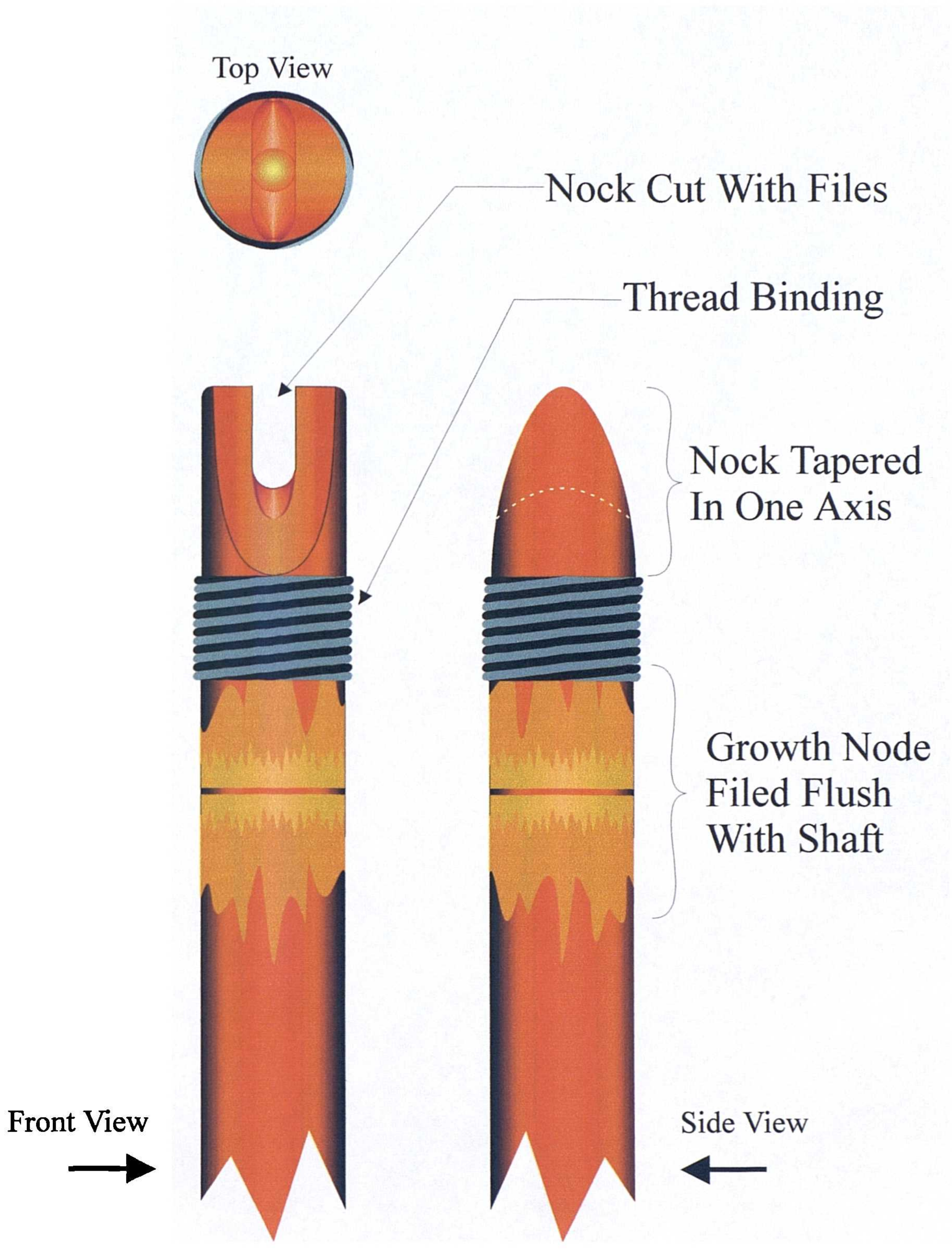
Tut'Ankhamun tomb artefact #370RR

The original file card from Howard Carter's examination of the arrows found in the tomb of Tut'Ankhamun and two arrows from the many which were found in the tomb

A from: The Griffith Institute, Oxford
B, C adapted from: McLoed 1982: Pl. IV

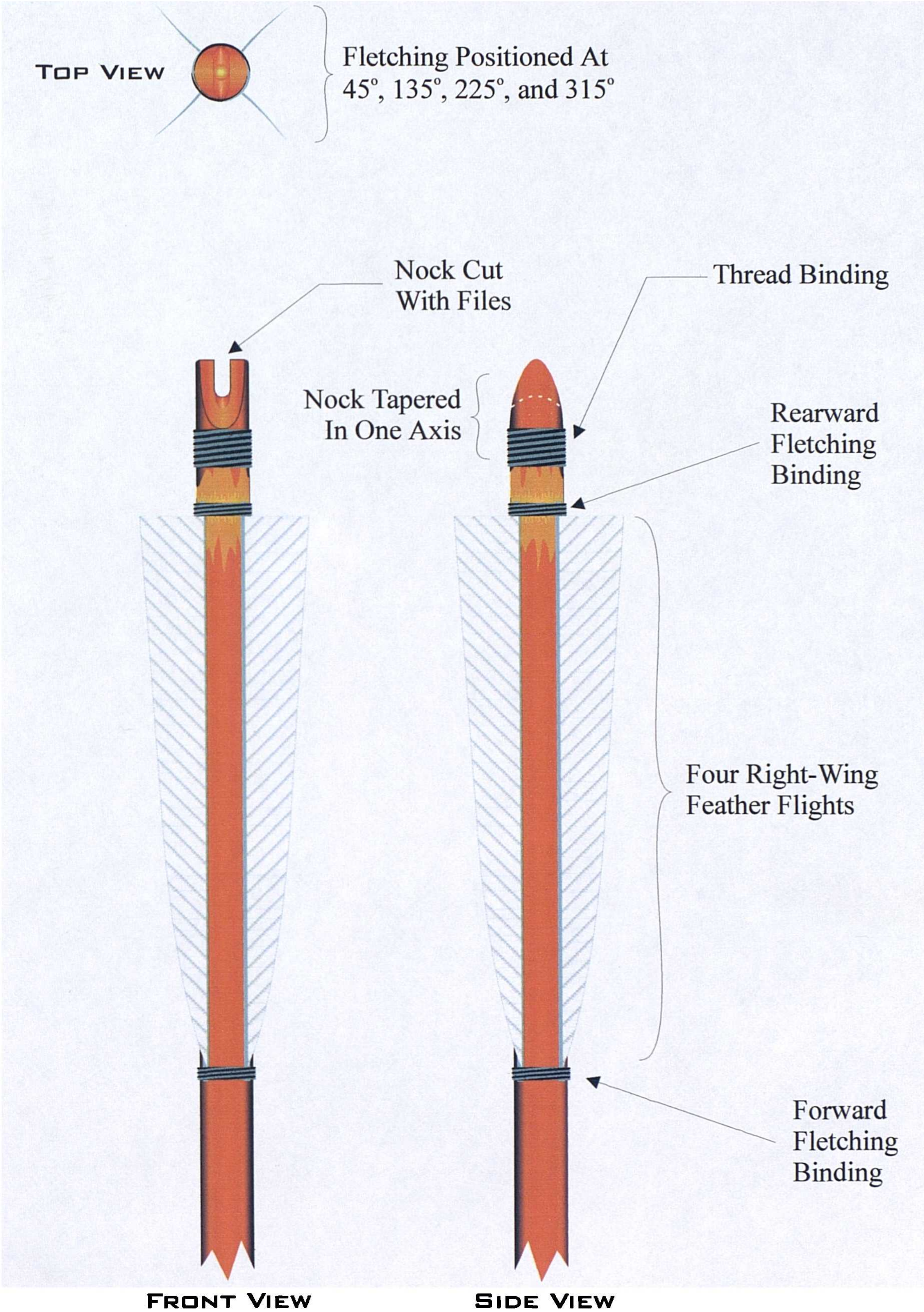
Fig. 114

Fig. 115



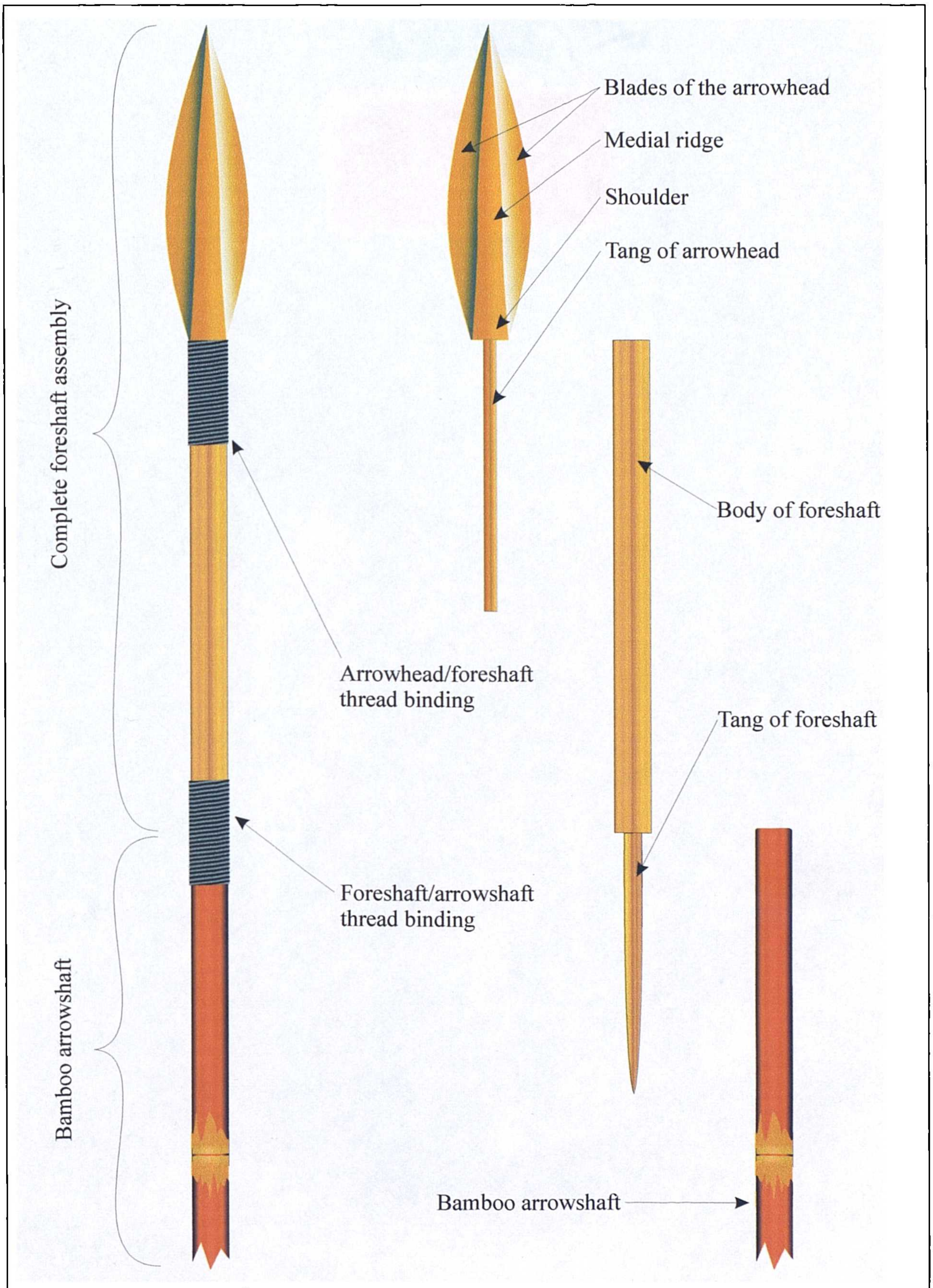
Detail of the construction of the nocks on the replica New Kingdom Egyptian arrows

Fig. 116



Detail of the construction of the fletching on the replica New Kingdom Egyptian arrows

Fig. 117



The component parts of the foreshaft assembly of the replica New Kingdom Egyptian arrows